A pre-letting conference will be held at 2:00p.m., July 25, 2022, at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa.

PUBLIC IMPROVEMENTS
CONTRACT DOCUMENTS

WRF BLENDED SLUDGE TANK MIXER REPLACEMENT

ACTIVITY ID
042022021

PLAN FILE NO.
643-086/114

WRA APPROVAL

APPROVAL DATE
August 16, 2022

WRA BOARD RESOLUTION NO.

CONTRACT NO.

CONTRACTOR

CONTRACT AMOUNT
$
The following documents are part of this contract:

Document

Instructions to Bidders
Official Publications
Proposal
Bid Bond
Contract
Performance, Payment and Maintenance Bond
Addenda:

Special Provisions:

Bidding Requirements
Contractual Requirements
Technical Specifications

Supplemental Specifications:

General Supplemental Specifications to SUDAS, 2022 Edition
WRA General Supplemental Specifications to SUDAS, 2022 Edition

PROJECT ENGINEER: Patrick A. Brown, P.E.

Phone Number: (515) 323-8027
INSTRUCTIONS TO BIDDERS

Activity ID 042022021
Project Name WRF Blended Sludge Tank Mixer Replacement
Fed/St. Project No.

The work comprising the above referenced project shall be constructed in accordance with the SUDAS Standard Specifications, 2022 Edition; and as further modified by the supplemental specifications and special provisions included in the contract documents. The Des Moines City Engineer is the Engineer. The terms used in the contract documents are defined in said SUDAS Standard Specifications. The Des Moines Metropolitan Wastewater Reclamation Authority is the Contracting Authority on this project and shall hereinafter be referred to as the "Jurisdiction". Before submitting your bid, please review the SUDAS Standard Specifications, in particular, Division 1 - General Provisions and Covenants, including the sections regarding proposal requirements, bonding, contract execution and insurance requirements. Please be certain that all documents have been properly completed and submit them to the City Clerk, 1st Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, 50309.

I. BID SECURITY

The bid security must be in the minimum amount of 10% of the total bid amount including all add alternates (do not deduct the amount of deduct-alternates). Bid security shall be as defined in Section 26.8 of the Iowa Code and shall be in the form of a cashier's check or certified check drawn on a state-chartered or federally chartered bank, or a certified share draft drawn on a state-chartered or federally chartered credit union, or a bid bond executed by a corporation authorized to contract as a surety in Iowa or satisfactory to the Jurisdiction. The bid bond must be submitted on the enclosed Bid Bond form (DSM Urban 04/20/98) as no other bid bond forms are acceptable. All signatures on the bid bond must be original signatures in ink; facsimile (fax) of any signature on the bid bond is not acceptable. Bid security other than said bid bond shall be made payable to the Des Moines Metropolitan Wastewater Reclamation Authority. "Miscellaneous Bank Checks", and personal checks, as well as "Money Orders" and "Traveler's Checks" issued by persons, firms or corporations licensed under Chapter 533B of the Iowa Code, are not acceptable bid security. NOTE: If the Bidder submits Bid Security in the form of a Bid Bond, and the Bidder wishes to have their Bid Bond returned to them after an approved contract and bond has been executed or after there is a rejection of all bids (in accordance with Iowa Code 26.10), the Bidder shall include a self-addressed envelope with the Bid Bond.

II. SUBMISSION OF THE PROPOSAL AND IDENTITY OF BIDDER

A. The proposal shall be sealed in an envelope, properly identified as the Proposal with the project title and the name and address of the bidder, and deposited with the Jurisdiction at or before the time and at the place provided in the Notice to Bidders. It is the sole responsibility of the bidder to see that its proposal is delivered to the Jurisdiction prior to the time for opening bids, along with the appropriate bid security sealed in the separate envelope identified as Bid Security and attached to the outside of the bid proposal envelope. Any proposal received after the scheduled time for the receiving of proposals will be returned to the bidder unopened and will not be considered. Bidders must either utilize the two envelopes provided with the Bidding documents, or Bidders provide their own two envelopes, for their proposals and bid security for submission of their bids.

Sales Tax: The bidder should not include sales tax in the bid pursuant to Iowa Code. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

Accessibility for individuals with disabilities. The City of Des Moines is pleased to provide accommodations to individuals with disabilities or groups and encourages participation in City government. To better serve you, please notify us at least three business days in advance when possible at 515-283-4209, should special accommodations be required.
B. All pages of the Proposal must be returned. The following documents shall be completed, signed and returned in the Proposal envelope.

PROPOSAL - Complete each of the following parts:
- Part B - Acknowledgement of Addenda, if any have been issued;
- Part C - Bid Items, Quantities and Prices;
- Part F - Additional Requirements; The following proposal attachment documents must be completed and attached:

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ATTACHMENT</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Reciprocal Resident Bidder and Labor Force</td>
</tr>
<tr>
<td>2.</td>
<td>General</td>
</tr>
</tbody>
</table>

- Part G - Identity of Bidder.

The Bidder shall sign the proposal. The signature on the proposal and all proposal attachments must be an original signature in ink signed by the same individual who is the Company Owner or an authorized Officer of the Company; copies or facsimile of any signature will not be accepted. The Bidder Status Form (PROPOSAL Part F Item 2B), is required by the Iowa Labor Commissioner, pursuant to Iowa Admin. Code rule 875-156.2(1). The Bidder must complete and submit the Bidder Status Form, signed by an authorized representative of the Bidder, with their bid proposal. Under Iowa Admin. Code rule 875-156.2(1), failure to provide the Bidder Status Form with the bid may result in the bid being deemed non-responsive and may result in the bid being rejected. The Worksheet: Authorization to Transact Business from the Labor Commissioner is included on page 3 of 3 of the Instructions to Bidders, to assist Bidders in completing the Bidder Status Form.

C. Out-of-State Contractors:

1. Pursuant to Section 91C.7 of the Iowa Code, an out-of-state contractor, before commencing a contract in excess of five thousand dollars in value in Iowa, shall file a bond with the Division of Labor Services of the Iowa Department of Workforce Development. The contractor should contact 515-242-5871 for further information. Prior to contract execution, the City Engineer may forward a copy of this contract to the Iowa Department of Workforce Development as notification of pending construction work. It is the contractor's responsibility to comply with said Section 91C.7 before commencing this work.

2. Prior to entering into contract, the designated low bidder, if it be a corporation organized under the laws of a state other than Iowa, shall file with the Engineer a certificate from the Secretary of the State of Iowa showing that it has complied with all the provisions of Chapter 490 of the Code of Iowa, or as amended, governing foreign corporations. For further information contact the Iowa Secretary of State Office at 515-281-5204.

III. GENERAL

A. All bid documents must be submitted as printed. No alterations, additions, or deletions are permitted. If the Bidder notes a requirement in the contract documents that the Bidder believes will require a conditioned or unsolicited alternate bid, the Bidder must immediately notify the Engineer in writing. The Engineer will issue any necessary interpretation by an addendum.

B. Additional information regarding addenda, plan holders, bid tabulations, etc. can be found on the Engineering Department web site at <http://www.dmgov.org/Departments/Engineering/Pages/BidsContracts.aspx>.
Worksheet: Authorization to Transact Business

This worksheet may be used to help complete Part A of the Resident Bidder Status Form. If at least one of the following describes your business, you are authorized to transact business in Iowa.

Yes___ No___ My business is currently registered as a contractor with the Iowa Division of Labor.

Yes___ No___ My business is a sole proprietorship and I am an Iowa resident for Iowa income tax purposes.

Yes___ No___ My business is a general partnership or joint venture. More than 50 percent of the general partners or joint venture parties are residents of Iowa for Iowa income tax purposes.

Yes___ No___ My business is an active corporation with the Iowa Secretary of State and has paid all fees required by the Secretary of State, has filed its most recent biennial report, and has not filed articles of dissolution.

Yes___ No___ My business is a corporation whose articles of incorporation are filed in a state other than Iowa, the corporation has received a certificate of authority from the Iowa secretary of state, has filed its most recent biennial report with the secretary of state, and has neither received a certificate of withdrawal from the secretary of state nor had its authority revoked.

Yes___ No___ My business is a limited liability partnership which has filed a statement of qualification in this state and the statement has not been canceled.

Yes___ No___ My business is a limited liability partnership which has filed a statement of qualification in a state other than Iowa, has filed a statement of foreign qualification in Iowa and a statement of cancellation has not been filed.

Yes___ No___ My business is a limited partnership or limited liability limited partnership which has filed a certificate of limited partnership in this state, and has not filed a statement of termination.

Yes___ No___ My business is a limited partnership or a limited liability limited partnership whose certificate of limited partnership is filed in a state other than Iowa, the limited partnership or limited liability limited partnership has received notification from the Iowa secretary of state that the application for certificate of authority has been approved and no notice of cancellation has been filed by the limited partnership or the limited liability limited partnership.

Yes___ No___ My business is a limited liability company whose certificate of organization is filed in Iowa and has not filed a statement of termination.

Yes___ No___ My business is a limited liability company whose certificate of organization is filed in a state other than Iowa, has received a certificate of authority to transact business in Iowa and the certificate has not been revoked or canceled.

309-6001 02-14
NOTICE TO BIDDERS

DES MOINES METROPOLITAN WASTEWATER RECLAMATION AUTHORITY PUBLIC IMPROVEMENT

Time and Place for Filing Sealed Proposals. Sealed bids for the work comprising each improvement as stated below must be filed at or before 11:00 a.m. on August 2, 2022, in the office of the City Clerk, 1st Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, 50309.

Accessibility for individuals with disabilities. The City of Des Moines is pleased to provide accommodations to individuals with disabilities or groups and encourages participation in City government. To better serve you, please notify us at least three business days in advance when possible at 515-283-4209, should special accommodations be required.

Time and Place Sealed Proposals Will be Opened and Considered. Sealed proposals will be opened and bids tabulated at 11:00 a.m., on August 2, 2022, in the City Council Chambers, 2nd Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, for consideration by the Des Moines Metropolitan Wastewater Reclamation Authority Board (WRA Board) at its meeting on August 16, 2022. The Des Moines Metropolitan Wastewater Reclamation Authority (Jurisdiction) reserves the right to reject any and all bids.

Time for Commencement and Completion of Work. Work on each improvement shall be commenced upon approval of the contract by the WRA Board, and completed as stated below.

Bid Security. Each bidder shall accompany its bid with bid security as defined in Section 26.8 of the Iowa Code and as specified by the Jurisdiction.

Contract Documents. Copies of the contract documents will be available after June 21, 2022, from the City Engineer's Office, 2nd Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa 50309, at no cost, phone (515-283-4573).

Preference for Iowa Products and Labor. By virtue of statutory authority, preference will be given to products and provisions grown and coal produced within the State of Iowa, and to Iowa domestic labor, to the extent lawfully required under Iowa statutes.

Sales Tax. The bidder should not include sales tax in the bid. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

General Nature of Public Improvement.
WRF Blended Sludge Tank Mixer Replacement, 042022021

The improvement includes replacement and modifications of the existing blended sludge wet well mixers, controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room to an adjacent room within Building 75 including installation of electrical gear and associated components, and other incidental items; all in accordance with the contract documents, including Plan File No. 643-086/114, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa.

This project shall be fully completed not later than September 15, 2023.

Engineer's Construction Estimate. $1,147,800.00

Preletting Conference. A pre-letting conference will be held at 2:00p.m., July 25, 2022, at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa.
NOTICE OF PUBLIC HEARING
DES MOINES METROPOLITAN WASTEWATER RECLAMATION AUTHORITY PUBLIC IMPROVEMENT

Public Hearing on Proposed Contract Documents and Estimated Costs for Improvement. A public hearing will be held by the Des Moines Metropolitan Wastewater Reclamation Authority Board on the proposed contract documents (plans, specifications and form of contract) on file in the City Engineer’s Office, and estimated cost for each improvement at its meeting on August 16, 2022, at 1:30 p.m., in the Des Moines Metropolitan Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa. Please check the posted agenda in advance of the August 16, 2022 meeting for any update on the manner in which the public hearing will be conducted to comply with COVID-19 social distancing and safety guidelines. The Des Moines Metropolitan Wastewater Reclamation Authority Board Meetings are open to all individuals regardless of disability. To better serve you, please notify the Board Secretary at least three business days in advance, when possible, should special accommodations be required.

General Nature of Public Improvement

WRF Blended Sludge Tank Mixer Replacement, 042022021

The improvement includes replacement and modifications of the existing blended sludge wet well mixers, controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room to an adjacent room within Building 75 including installation of electrical gear and associated components, and other incidental items; all in accordance with the contract documents, including Plan File No. 643-086/114, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa

Published in the Des Moines Register
July 27, 2022
To the Chairperson and Members of the Board of the Des Moines Metropolitan Wastewater Reclamation Authority

PROPOSAL: PART A - SCOPE

The Des Moines Metropolitan Wastewater Reclamation Authority, hereinafter called the "Jurisdiction", has need of a qualified contractor to complete the work comprising the below referenced improvement. The undersigned Bidder hereby proposes to complete the work comprising the below referenced improvements or project as specified in the contract documents, which are officially on file with the Jurisdiction, in the Des Moines City Engineer's Office, at the prices hereinafter provided in Part C of this Proposal, for the following described improvements:

WRF Blended Sludge Tank Mixer Replacement, 042022021

The improvement includes replacement and modifications of the existing blended sludge wetwell mixers, controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room to an adjacent room within Building 75 including installation of electrical gear and associated components, and other incidental items; all in accordance with the contract documents, including Plan File No. 643-086/1-4, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa

PROPOSAL: PART B - ACKNOWLEDGEMENT OF ADDENDA

The Bidder hereby acknowledges that all addenda become a part of the contract documents when issued, and that each such addendum has been received and utilized in the preparation of this bid. The Bidder hereby acknowledges receipt of the following addenda by inserting the number of each addendum in the blanks below:

ADDENDUM NUMBER

ADDENDUM NUMBER

ADDENDUM NUMBER

ADDENDUM NUMBER

and certifies that said addenda were utilized in the preparation of this bid.

PROPOSAL: PART C - BID ITEMS, QUANTITIES AND PRICES

UNIT BID PRICE CONTRACTS: The bidder must provide all unit prices, the amount, the total construction cost, any alternate price(s), and the total construction cost plus any add-alternates if there are alternates on the proposal on Proposal Attachment: Part C - Bid Items, Quantities, and Prices. The total construction cost plus any add-alternates selected by the Jurisdiction shall be used for comparison of bids. The total construction cost plus any add-alternates shall be used for determining the sufficiency of the bid security.

PROPOSAL: WRF Blended Sludge Tank Mixer Replacement

RETURN WITH BID

Activity ID 042022021
BASE BID CONTRACTS: The bidder must provide any bid price(s), the total base bid price, any alternate price(s), and the total base bid plus any add-alternates if there are alternates on the proposal on Proposal Attachment: Part C - Bid Items, Quantities, and Prices. The total base bid plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total base bid plus any add-alternates shall be used for determining the sufficiency of the bid security.

PROPOSAL: PART D - GENERAL

The Bidder hereby acknowledges that the Jurisdiction, in advertising for public bids for this project, reserves the right to:

1. Reject any or all bids. Award of the contract, if any, to be to the lowest responsible, responsive bidder; and
2. Reject any or all alternates in determining the items to be included in the contract. Designation of the lowest responsible, responsive bidder to be based on comparison of the total bid plus any selected alternates; and
3. Make such alterations in the contract documents or in the proposal quantities as it determines necessary in accordance with the contract documents after execution of the contract. Such alterations shall not be considered a waiver of any conditions of the contract documents, and shall not invalidate any of the provisions thereof; and

The Bidder hereby agrees to:

1. Enter into a contract, if this proposal is selected, in the form approved by the Jurisdiction and provide the following documents:
   - Proof of registration with the Iowa Division of Labor in accordance with Chapter 91C of the Iowa Code by providing a valid Registration Number,
   - Proof of insurance by a Certificate(s) of Insurance,
   - A performance, maintenance, and payment bond; and
2. Forfeit bid security, not as a penalty but as liquidated damages, upon failure to enter into such contract and/or to furnish said documents and information as requested in Item 1 above acceptable to the Des Moines City Engineer; and
3. Commence the work on this project on or after the date a written Notice to Proceed is issued by the Jurisdiction, and to fully complete the project not later than September 15, 2023; and to pay liquidated damages for noncompliance with said completion provisions at the rate of One Thousand Two Hundred and 00/100 ($1,200.00) for each calendar day thereafter that the work remains incomplete.

PROPOSAL: PART E - NON-COLLUSION AFFIDAVIT

The Bidder hereby certifies:

1. That this proposal is not affected by, contingent on, or dependent on any other proposal submitted for any improvement with the Jurisdiction; and
2. That no individual employed by the Bidder has employed any person to solicit or procure the work on this project, nor will any employee of the Bidder make any payment or agreement for payment of any compensation in connection with the procurement of this project; and
3. That no part of the bid price received by the Bidder was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the bid, other than the payment of their normal compensation to persons regularly employed by the Bidder whose services in connection with the construction of the project were in the regular course of their duties for the Bidder; and
4. That this proposal is genuine and not collusive or sham; that the Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought, by agreement or collusion, or communication or conference, with any person, to fix the bid price of the Bidder or of any other bidder, and that all statements in this proposal are true; and

5. That the individual(s) executing this proposal have the authority to execute this proposal on behalf of the Bidder.

PROPOSAL: PART F - ADDITIONAL REQUIREMENTS

The Bidder hereby agrees to comply with the additional requirements listed below, which are included in this proposal and identified as proposal attachments:

<table>
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<tbody>
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<td>Reciprocal Resident Bidder and Labor Force</td>
</tr>
<tr>
<td>2.</td>
<td>General</td>
</tr>
</tbody>
</table>
PROPOSAL: PART G - IDENTITY OF BIDDER

The Bidder shall indicate whether the bid is submitted by a/an

□ Individual,
  Sole Proprietorship

□ Partnership

□ Corporation

□ Limited Liability Company

□ Joint-venture: all parties must join-in and execute all documents

□ Other

A contract will not be executed until the apparent low Bidder is registered with the Iowa Commissioner of Labor pursuant to Section 91C.5 of the Iowa Code. The Bidder should contact 515-242-5871 for registration information.

NOTE: The signature on this proposal must be an original signature in ink; copies or facsimile of any signature will not be accepted.

By

Bidder

Signature

Name (Print/Type)

Title

Street Address

City, State, Zip Code

Telephone Number / Email Address

Engineering Department Staff will contact the apparent low Bidder and obtain the name and title of the company's owner, president, CEO, etc. if a different person than entered above.
This is a base bid price contract. The bidder must provide any bid price(s), the total base bid price, any alternate price(s), and the total base bid plus any add-alternates if there are alternates on the proposal. The total base bid plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total base bid plus any add-alternates shall be used for determining the sufficiency of the bid security.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>ESTIMATED UNITS</th>
<th>UNIT QUANTITY</th>
<th>PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WRF Blended Sludge Tank Mixer Replacement, Complete as Specified and Described in Contract Documents</td>
<td>LS</td>
<td>1</td>
<td>$</td>
<td>$</td>
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</table>

TOTAL CONSTRUCTION COST $
ITEM 1 - RECIPROCAL RESIDENT BIDDER AND LABOR FORCE

Iowa Code section 73A.21 provides for a Reciprocal Resident Bidder and Labor Force preference.

Because of the nature of this project (i.e. Federal-aid participation), the Reciprocal Resident Bidder and Labor Force preference,

- ☐ shall not apply to this project, and the bidder need not complete the Resident Bidder Information below.
- ☑ shall apply to this project, and the bidder shall complete the Resident Bidder Information below.

To implement section 73A.21, the Iowa Labor Commissioner adopted chapter 156 of the Iowa Administrative Code, "Bidder Preferences in Government Contracting". Iowa Admin. Code rule 875-156.2(1) requires each bidder to complete the attached Bidder Status Form. The Bidder must complete and submit the Bidder Status Form, signed by an authorized representative of the bidder, with their bid Proposal. Under Iowa Admin. Code rule 875-156.2(1), failure to provide the statement with the bid may result in the bid being deemed nonresponsive and may result in the bid being rejected.
Bidder Status Form

To be completed by all bidders Part A

Please answer “Yes” or “No” for each of the following:

Yes____ No____ My company is authorized to transact business in Iowa.

(To help you determine if your company is authorized, please review the "Worksheet: Authorization to Transact Business", on page 3 of the "Instructions to Bidders").

Yes____ No____ My company has an office to transact business in Iowa.

Yes____ No____ My company’s office in Iowa is suitable for more than receiving mail, telephone calls, and e-mail.

Yes____ No____ My company has been conducting business in Iowa for at least 3 years prior to the first request for bids on this project.

Yes____ No____ My company is not a subsidiary of another business entity or my company is a subsidiary of another business entity that would qualify as a resident bidder in Iowa.

If you answered “Yes” for each question above, your company qualifies as a resident bidder. Please complete Parts B and D of this form.

If you answered “No” to one or more questions above, your company is a nonresident bidder. Please complete Parts C and D of this form.

To be completed by resident bidders Part B

My company has maintained offices in Iowa during the past 3 years at the following addresses:

<table>
<thead>
<tr>
<th>Dates:</th>
<th>To Address:</th>
<th>City, State, Zip:</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

You may attach additional sheet(s) if needed.

To be completed by non-resident bidders Part C

1. Name of home state or foreign country reported to the Iowa Secretary of State:

2. Does your company’s home state or foreign country offer preferences to bidders who are residents? Yes____ No____

3. If you answered “Yes” to question 2, identify each preference offered by your company’s home state or foreign country and the appropriate legal citation.

You may attach additional sheet(s) if needed.

To be completed by all bidders Part D

I certify that the statements made on this document are true and complete to the best of my knowledge and I know that my failure to provide accurate and truthful information may be a reason to reject my bid.

Firm Name: ___________________________

Signature: ___________________________ Date: ___________________________

You must submit the completed form to the governmental body requesting bids per 875 Iowa Administrative Code Chapter 156.

This form has been approved by the Iowa Labor Commissioner.

309-6001 02-14
ITEM 2 - GENERAL

1. The work under this proposal shall be constructed in accordance with the SUDAS Standard Specifications, 2022 Edition, and as further modified by the supplemental specifications and special provisions included in the contract documents.

   **Alternate Sales Tax:**
   Section 1023, 1.08, B, of the Supplemental Specifications shall apply. The bidder should not include sales tax in the bid. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

2. The Bidder hereby acknowledges that the Des Moines Metropolitan Wastewater Reclamation Authority in advertising for public bids for this work reserves the right to give a limited notice to proceed of a duration not longer than three months. This limited notice to proceed shall be given where all necessary right-of-way has not yet been acquired. The limited notice to proceed will allow construction to proceed as far as possible and practical on the right-of-way, which has been acquired.

3. The Bidder hereby acknowledged and agrees:
   • To comply with the Equal Employment Opportunity Program included in the City of Des Moines Contract Compliance Program, which is available at the following website <http://www.dmgov.org/Departments/Engineering/PDF/Contract%20Compliance%20Program%20(June%202017).pdf> or from the City Engineer’s Office.
   • To comply with any and all applicable provisions of the Des Moines Human Rights Ordinance, Chapter 62, of the Des Moines Municipal Code.
   • Not to discriminate against any employees, or applicants for employment, on the basis of age, race, religion, creed, color, sex, sexual orientation, national origin, ancestry, disability, familial status or gender identity.
   • To include this provision in all subcontracts for this project.

4. The City’s Overall Annual DBE/TSB Goal for this project is 6.03%, which represents a target that the City would like to achieve in including DBE/TSB participation on City contracts; and is not a mandatory goal for this project. The Certified Directory of DBEs is available at the following website <https://secure.iowadot.gov/DBE/Directory/Index/>. The Certified Directory of TSBs is available at the following website <https://iowaedal.dynamics365portals.us/tsb-search/>.
BID BOND

KNOW ALL BY THESE PRESENTS:

That we, ________________________________________, as Principal, and
________________________________________________, as Surety, are held and firmly
bound unto the Des Moines Metropolitan Wastewater Reclamation Authority, as Obligee (hereinafter the
"Jurisdiction"), in the penal sum of

________________________________________________ dollars

($____________) lawful money of the United States, for which payment the Principal and Surety bind
themselves, their heirs, executors, administrators, successors, and assigns jointly and severally, firmly by
these presents.

The Principal has submitted to the Jurisdiction a proposal to enter into a contract in writing, for the following
described improvements:

WRF Blended Sludge Tank Mixer Replacement, 042022021

The improvement includes replacement and modifications of the existing blended sludge wet well mixers,
controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room
to an adjacent room within Building 75 including installation of electrical gear and associated components,
and other incidental items; all in accordance with the contract documents, including Plan File No. 643-
086/114, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des
Moines, Iowa

The Surety hereby stipulates and agrees that the obligations of the Surety and its Bond will be in no way
impaired or affected by any extension of the time within which the Jurisdiction may accept the Bid or execute
a Contract; and the Surety does hereby waive notice of any such extension.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the
venue will be Polk County, State of Iowa. If legal action is required by the Jurisdiction against the Surety or
Principal to enforce the provisions of this bond or to collect the monetary obligation accruing to the benefit of
the Jurisdiction, the Surety or Principal agrees to pay the Jurisdiction all outlay and expense incurred by the
Jurisdiction in enforcing any of the provisions of this Bond. All rights, powers, and remedies of the
Jurisdiction are cumulative and not alternative and are in addition to all rights, powers and remedies given to
the Jurisdiction by law. The Jurisdiction may proceed against the Surety for any amount guaranteed
hereunder whether action is brought against Principal or whether or not the Principal is joined in the action.
As used herein, the phrase “all outlay and expense” is not to be limited in any way, but includes the actual and
reasonable costs and expenses incurred by the Jurisdiction including interest, benefits and overhead where
applicable. Accordingly, "all outlay and expense" would include but not be limited to all contract or employee
expense, outside experts, attorneys fees (including overhead expenses of the Jurisdiction's staff attorneys), and
all costs and expenses of litigation as they are incurred by the Jurisdiction.
If the proposal by the Principal is accepted and the Principal enters into a contract with the Jurisdiction in accordance with the terms of the proposal, including the provision of insurance and bond as specified in the contract documents with good and sufficient surety for the faithful performance of the contract, for the prompt payment of labor and material furnished in the prosecution of the work, and for the maintenance of the improvements as may be required in the contract documents or, in the event the Principal does not enter into a contract and provide the required insurance and bonds, the Principal pays the penal sum to the Jurisdiction, then this obligation will become null and void; otherwise, the Surety shall pay to the Jurisdiction the full amount of the bid bond, together with court costs, attorney's fees, and any other expense of recovery.

Signed and sealed this __________ day of ______________________, 20________

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<thead>
<tr>
<th>SURETY:</th>
<th>PRINCIPAL:</th>
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<tr>
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<td>Company Name</td>
<td>Address</td>
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<td>City, State Zip Code</td>
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<td>Telephone Number</td>
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NOTE:

1. All signatures on this bid bond must be original signatures in ink; copies or facsimile of any signature will not be accepted.

2. This bond must be sealed with the Surety's raised, embossed seal.

3. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety's raised, embossing seal or security watermark.

4. The name and signature of the Surety's Attorney-in-Fact/Officer entered on this bond must be exactly as listed on the Certificate or Power of Attorney accompanying this bond.
ENGINEERING DEPARTMENT  
CITY OF DES MOINES, IOWA  

CONTRACT NO.  
WRA BOARD RESOLUTION NO. 8/16/2022

CONTRACT

THIS CONTRACT, made and entered into at Des Moines, Iowa, on _____________, by and between the Des Moines Metropolitan Wastewater Reclamation Authority, by its WRA Board Chair, upon order of its Des Moines Metropolitan Wastewater Reclamation Authority Board, hereinafter the "Jurisdiction", and ________________________________, hereinafter the "Contractor".

WITNESSETH:

The Contractor hereby agrees to complete the work comprising the below referenced improvement as specified in the contract documents, which are officially on file with the Jurisdiction, in the Des Moines City Engineer's Office. This contract includes all contract documents. The work under this contract shall be constructed in accordance with the SUDAS Standard Specifications, 2022 Edition; and as further modified by the supplemental specifications and special provisions included in said contract documents, and the Contract Attachments attached hereto. The Des Moines City Engineer is the Engineer. The Contractor further agrees to complete the work in strict accordance with said contract documents, and to guarantee the work as required by law, for the time required in said contract documents, after its acceptance by the Jurisdiction.

This contract is awarded and executed for completion of the work specified in the contract documents for the bid prices shown on the Contract Attachment: Item 2: Bid Items, Quantities and Prices which were proposed by the Contractor in its proposal submitted in accordance with the Notice to Bidders for the following described improvements:

WRF Blended Sludge Tank Mixer Replacement, 042022021
The improvement includes replacement and modifications of the existing blended sludge wet well mixers, controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room to an adjacent room within Building 75 including installation of electrical gear and associated components, and other incidental items; all in accordance with the contract documents, including Plan File No. 643-086/114, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa

The Contractor agrees to perform said work for and in consideration of the Jurisdiction's payment of the bid amount of _______________________________ dollars ($_______________________) which amount shall constitute the required amount of the performance, payment, and maintenance bond. The Contractor hereby agrees to commence work under this contract on or after the date a written Notice to Proceed is issued by the Jurisdiction and to fully complete the project not later than September 15, 2023; and to pay liquidated damages for noncompliance with completion provisionin the amount of One Thousand Two Hundred and 00/100 dollars($1,200.00), for each calendar day thereafter that the work remains incomplete.
IN WITNESS WHEREOF, the Parties hereto have executed this instrument, in triplicate on the date first shown written.

**JURISDICTION:**

By _____________________________
Sara Kurovski, WRA Board Chair

(Seal)

**ATTEST:**

Chelsea Huisman, Board Secretary

**FORM APPROVED BY:**

Kathleen Vanderpool, Deputy City Attorney

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<td>By _____________________________</td>
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<tr>
<td>Contractor</td>
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</table>

| By _____________________________ |
| Signature |

| _____________________________ |
| Title |

| _____________________________ |
| Street Address |

| _____________________________ |
| City, State - Zip Code |

| / |
| Telephone Number / Email Address |

**CONTRACTOR PUBLIC REGISTRATION INFORMATION To Be Provided By:**

1. **All Contractors:** The Contractor's Public Registration Number, issued by the Iowa Commissioner of Labor pursuant to Section 91C.5 of the Iowa Code, is as follows:
   - Number

2. **Out-of-State Contractors:**
   
   A. Pursuant to Section 91C.7 of the Iowa Code, an out-of-state contractor, before commencing a contract in excess of five thousand dollars in value in Iowa, shall file a bond with the division of labor services of the department of workforce development. The contractor should contact 515-242-5871 for further information. Prior to contract execution, the City Engineer may forward a copy of this contract to the Iowa Department of Workforce Development as notification of pending construction work. It is the contractor's responsibility to comply with said Section 91C.7 before commencing this work.

   B. Prior to entering into contract, the designated low bidder, if it be a corporation organized under the laws of a state other than Iowa, shall file with the Engineer a certificate from the Secretary of the State of Iowa showing that it has complied with all the provisions of Chapter 490 of the Code of Iowa, or as amended, governing foreign corporations. For further information contact the Iowa Secretary of State Office at 515-281-5204.

**NOTE:** All signatures on this contract must be original signatures in ink: copies or facsimile of any signature will not be accepted.
CORPORATE ACKNOWLEDGEMENT

State of _____________________________) SS
________________________ County )

On this _______ day of __________, 20____, before me, the undersigned, a Notary Public in and for the State of ________, personally appeared ___________________________ and ___________________________, to me known, who, being by me duly sworn, did say that they are the __________________________ and __________________________, respectively, of the corporation executing the foregoing instrument; that (no seal has been procured by) (the seal affixed thereto is the seal of) the corporation; that said instrument was signed (and sealed) on behalf of the corporation by authority of this Board of Directors; and __________________________ acknowledged the execution of the instrument to be the voluntary act and deed of the corporation, by it and by them voluntarily executed.

________________________________________
Notary Public in and for the State ___________________________

My commission expires
________________________________________
1. The Contractor acknowledges and agrees:
   • To comply with the Equal Employment Opportunity Program included in the City of Des Moines Contract Compliance Program, which is available at the following website http://www.dmgov.org/Departments/Engineering/PDF/Contract%20Compliance%20Program%20(June%202017).pdf or from the City Engineer’s Office.
   • To comply with any and all applicable provisions of the Des Moines Human Rights Ordinance, Chapter 62, of the Des Moines Municipal Code.
   • Not to discriminate against any employees, or applicants for employment, on the basis of age, race, religion, creed, color, sex, sexual orientation, national origin, ancestry, disability, familial status or gender identity.
   • To include this provision in all subcontracts for this project.

2. The Contractor agrees to comply with the requirements of the Des Moines Metropolitan Wastewater Reclamation Authority Contract Compliance Program as referenced in the proposal. Final acceptance of the project will not be made until the Contractor has submitted to the City Engineer a notarized summary of payments to and scope of work by all DBE/TSB subcontractors.

3. The City of Des Moines Master Construction Safety Packet (Safety Plan) is available at http://www.dmgov.org/Departments/Engineering/PDF/MasterConstructionSafetyPacket.pdf and is also available upon request from the Engineering Department. The Engineering Department will make available a copy of the City of Des Moines Safety Plan to the Contractor when the contract is awarded. The Contractor understands and agrees that said Safety Plan is for the Contractor’s information only and that it is the Contractor’s sole responsibility to provide, or make available, this safety information to all its Subcontractors.

4. The Contractor understands and agrees that the construction of the work included in this contract is by its nature dangerous work. The Contractor agrees:
   • That the Contractor should have a safety program; however, the Contractor need not submit a safety program to the Des Moines Metropolitan Wastewater Reclamation Authority, and Des Moines Metropolitan Wastewater Reclamation Authority staff will not review or approve the Contractor’s safety program. The Des Moines Metropolitan Wastewater Reclamation Authority assumes that the Contractor will maintain a safe worksite; however, Des Moines Metropolitan Wastewater Reclamation Authority staff will not intrude in the Contractor’s responsibility for safety issues.
   • That until the work is accepted by the Jurisdiction; the work shall be in the custody of and under the charge, care, and control of the Contractor.
   • That the Contractor is responsible for the project area or work site.
   • That the Contractor is solely responsible for the safety of everyone on its work site.
   • That it is the Contractor’s sole responsibility to provide as safe a working site as possible given the nature of the work.
   • That it is the Contractor’s responsibility to notify and advise its employees, subcontractors, suppliers, and everyone on the worksite of the dangers associated with the work, and provide them with appropriate safety information to protect them from those dangers.

5. The Contractor acknowledges and agrees that no contract shall be binding upon the Des Moines Metropolitan Wastewater Reclamation Authority until said contract has been executed by the Bidder, and shall have been approved by the Des Moines Metropolitan Wastewater Reclamation Authority Board and executed by the WRA Board Chair and attested to by the Board Secretary.
6. The Contractor agrees that sixty (60) days shall constitute a reasonable time within which it shall be required to make progress payments or final payment to subcontractors after each subcontractor's satisfactory performance of its work, all as required by Section 573.12 2.b.(2) of the Code of Iowa.
This is a base bid price contract. The bidder must provide any bid price(s), the total base bid price, any alternate price(s), and the total base bid plus any add-alternates if there are alternates on the proposal. The total base bid plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total base bid plus any add-alternates shall be used for determining the sufficiency of the bid security.

Activity ID 04-2022-021

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<th>ITEM</th>
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<td>WRF Blended Sludge Tank Mixer Replacement, Complete as Specified and Described in Contract Documents</td>
<td>LS</td>
<td>1</td>
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TOTAL CONSTRUCTION COST $
ENGINEERING DEPARTMENT
SURETY'S BOND NO
CITY OF DES MOINES, IOWA

PERFORMANCE, PAYMENT & MAINTENANCE BOND

KNOW ALL BY THESE PRESENTS:

That we, ____________________________________________________________________, as Principal (the "Contractor" or "Principal"), and ____________________________________________________________________, as Surety, are held and firmly bound unto the Des Moines Metropolitan Wastewater Reclamation Authority, as Obligee (the "Jurisdiction"), and to all persons who may be injured by any breach of any of the conditions of this Bond in the penal sum of ________________________ dollars ($_________), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, legal representatives and assigns, jointly and severally, firmly by these presents.

The conditions of the above obligations are such that whereas the Contractor entered into a contract with the Jurisdiction, bearing the date of __________, (the "Contract") wherein the Contractor undertakes and agrees to construct the following described improvements:

WRF Blended Sludge Tank Mixer Replacement, 04202021

The improvement includes replacement and modifications of the existing blended sludge wet well mixers, controls and associated supports, equipment, conduit and wiring, expansion of the existing electrical room to an adjacent room within Building 75 including installation of electrical gear and associated components, and other incidental items; all in accordance with the contract documents, including Plan File No. 643-086/114, located at Buildings 70 and 75 at the Wastewater Reclamation Facility, 3000 Vandalia Road, Des Moines, Iowa

and to faithfully perform all the terms and requirements of the Contract within the time specified, in a good and workmanlike manner, and in accordance with the Contract Documents. Provided however, that one year after the date of acceptance by the Jurisdiction as complete, of the work under the above referenced Contract, the maintenance portion of this Bond shall continue in force but the penal sum for maintenance shall be reduced to ________________________ dollars ($_________), which is the cost associated with those items shown on the Proposal and in the Contract which require a maintenance bond period in excess of one year.

It is expressly understood and agreed by the Contractor and Surety that the following provisions are a part of this Bond and are binding upon the Contractor and Surety, to-wit:

1. PERFORMANCE: The Contractor shall well and faithfully observe, perform, fulfill and abide by each and every covenant, condition and part of the Contract and Contract Documents, by reference made a part hereof, and shall indemnify and save harmless the Jurisdiction from all outlay and expense incurred by the Jurisdiction by reason of the Contractor's default or failure to perform as required. The Contractor shall also be responsible for the default or failure to perform as required under the Contract and Contract Documents by all its subcontractors, suppliers, agents, or employees furnishing materials or providing labor in the performance of the Contract.
2. **PAYMENT**: The Contractor and Surety on this bond hereby agree to pay all just claims submitted by persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the performance of the Contract, including but not limited to claims for all amounts due for labor, materials, lubricants, oil, gasoline, repairs on machinery, equipment and tools, consumed or used by the Contractor or any subcontractor, wherein the same are not satisfied out of the portion of the contract price which the Jurisdiction is required to retain until completion of the improvement, but the Contractor and Surety shall not be liable unless the claims have been established as provided by law. The Contractor and Surety hereby bind themselves to the obligations and conditions set forth in Iowa Code Chapter 573.

3. **MAINTENANCE**: The Contractor and the Surety shall, at their own expense:
   
   **A.** Remedy any and all defects that may develop in or result from work to be performed under the Contract within the period of one (1) year(s) from the date of acceptance of the work under the Contract, by reason of defects in workmanship or materials used in construction of the work;
   
   **B.** Keep all work in continuous good repair; and
   
   **C.** Pay the Jurisdiction's reasonable costs of monitoring and inspecting to assure that any defects are remedied, and to repay the Jurisdiction all outlay and expense incurred as a result of Contractor's and Surety's failure to remedy any defect as required by this section.

   Contractor's and Surety's obligation extends to defects in workmanship or materials not discovered or known to the Jurisdiction at the time the work was accepted.

4. **GENERAL**: Every Surety on this Bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:

   **A.** To consent without notice to any extension of time to the Contractor in which to perform the Contract;

   **B.** To consent without notice to any change in the Contract or Contract Documents, that increases the total contract price and the penal sum of this bond, provided that all such changes do not, in the aggregate, involve an increase of more than twenty percent of the total contract price, and that this Bond shall then be released as to such excess increase; and

   **C.** To consent without notice that this Bond shall remain in full force and effect until the contract is completed, whether completed within the specified contract period, within an extension thereof, or within a period of time after the contract period has elapsed and liquidated damages are being charged against the Contractor.

5. The Contractor and every Surety on this Bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:

   **A.** That no provision of this Bond or of any other contract shall be valid which limits to less than five years after the acceptance of the work under the Contract the right to sue on this Bond.
B. That as used herein, the phrase "all outlay and expense" is not to be limited in any way, but shall include the actual and reasonable costs and expenses incurred by the Jurisdiction including interest, benefits and overhead as applicable. Accordingly, "all outlay and expense" would include but not be limited to all contract or employee expense, all equipment usage or rental, materials, testing, outside experts, attorneys fees (including overhead expenses of the Jurisdiction's staff attorneys), and all costs and expenses of litigation as they are incurred by the Jurisdiction. It is intended the Contractor and Surety will defend and indemnify the Jurisdiction on all claims made against the Jurisdiction on account of Contractor's failure to perform as required in the Contract and Contract Documents, that all agreements and promises set forth in the Contract and Contract Documents, in approved change orders, and in this Bond will be fulfilled, and that the Jurisdiction will be fully indemnified so that it will be put into the position it would have been in had the Contract been performed in the first instance as required.

C. In the event the Jurisdiction incurs any "outlay and expense" in defending itself with respect to any claim as to which the Contractor or Surety should have provided the defense, or in the enforcement of the promises given by the Contractor in the Contract, Contract Documents, or approved change orders, or in the enforcement of the promises given by the Contractor and Surety in this Bond, the Contractor and Surety agree that they will make the Jurisdiction whole for all such outlay and expense, provided that the Surety's obligation under this Bond shall not exceed 125% of the penal sum of this Bond.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the venue thereof shall be Polk County, State of Iowa. If legal action is required by the Jurisdiction to enforce the provisions of this Bond or to collect the monetary obligation accruing to the benefit of the Jurisdiction, the Contractor and Surety agree, jointly and severally, to pay the Jurisdiction all outlay and expense incurred by the Jurisdiction. All rights, powers, and remedies of the Jurisdiction hereunder shall be cumulative and not alternative and shall be in addition to all rights, powers and remedies given to the Jurisdiction, by law. The Jurisdiction may proceed against the Surety for any amount guaranteed hereunder whether action is brought against the Contractor or whether or not the Contractor is joined in the action.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall faithfully perform all of the promises of the Principal, as set forth and provided in the Contract, in the Contract Documents, and in this Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

When a word, term, or phrase is used in this Bond, it shall be interpreted or construed first as defined in this Bond, the Contract, or the Contract Documents; second, if not defined in the Bond, Contract, or Contract Documents, it shall be interpreted or construed as defined in applicable provisions of the Iowa Code; third, if not defined in the Iowa Code, it shall be interpreted or construed according to its generally accepted meaning in the construction industry; and fourth, if it has no generally accepted meaning in the construction industry, it shall be interpreted or construed according to its common or customary usage.
Failure to specify or particularize shall not exclude terms or provisions not mentioned and shall not limit liability hereunder. The Contract and Contract Documents are hereby made a part of this Bond.

Witness our hands, in triplicate, this _______ day of __________________ , 20_____

PRINCIPAL:

__________________________

Contractor

By

__________________________

Signature

__________________________

Title

FORM APPROVED BY:

__________________________

Kathleen Vanderpool
Deputy City Attorney

SURETY:

__________________________

Surety Company

By

__________________________

Signature Attorney-in-Fact/Officer

__________________________

Name of Attorney-in-Fact/Officer

__________________________

Company Name

__________________________

Company Address

__________________________

City, State  Zip Code

__________________________

Company Telephone Number

NOTE:

1. All signatures on this performance, payment & maintenance bond must be original signatures in ink; copies or facsimile of any signature will not be accepted.

2. This bond must be sealed with the Surety’s raised, embossed seal.

3. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety’s raised, embossing seal.

4. The name and signature of the Surety’s Attorney-in-Fact/Officer entered on this bond must be exactly as listed on the Certificate or Power of Attorney accompanying this bond.

5. This bond form must be utilized as printed; no additions/deletions/alterations are permitted, other than providing the required information.
ENGINEERING DEPARTMENT
CITY OF DES MOINES, IOWA

SPECIAL PROVISION
BIDDING REQUIREMENTS
ON
WRF BLENDED SLUDGE TANK MIXER REPLACEMENT
ACTIVITY ID 04-2022-021

1) AWARD OF CONTRACT

The apparent low Bidder on this project will be required to furnish executed contract; Performance, Payment, and Maintenance Bond; and Certificate of Insurance; and NPDES Certification Statements, if required, in substantial compliance with the contract documents to the City of Des Moines Engineering Department before 12:00 noon on Friday, August 12, 2022. Completed documents in accordance with the contract documents and acceptable to the City of Des Moines Engineering and Legal Departments will be presented to the Des Moines Metropolitan Wastewater Reclamation Authority Board for award of this contract on Tuesday, August 16, 2022. This would allow construction to begin upon issuance of the Notice to Proceed in accordance with the Special Provisions.

By submission of a bid, the Bidder agrees that if the Bidder fails to furnish said executed contract; Performance, Payment, and Maintenance Bond; and Certificate of Insurance; and NPDES Certification Statements, if required, in substantial compliance with the contract documents to the Des Moines Engineering Department before 12:00 noon on Friday, August 12, 2022; the amount of the Bidder’s bid security may become the property of the Des Moines Metropolitan Wastewater Reclamation Authority and may be retained—not as a penalty but as liquidated damages. The award of the contract may then, at the discretion of the Des Moines Metropolitan Wastewater Reclamation Authority Board, be made to the next-lowest responsible Bidder, or the work may be readvertised or may be constructed by the Des Moines Metropolitan Wastewater Reclamation Authority Board in any legal manner. Notice to Proceed will not be issued until the Contractor’s insurance is in compliance with the specifications.

The Bidder is reminded that all subcontractors must be approved by the Des Moines Metropolitan Wastewater Reclamation Authority Board at the time the contract is awarded, if possible. The Bidder should submit a letter requesting approval of any subcontractors along with the subcontractor’s NPDES Certification Statement, if required, at the time its executed contracts are submitted for approval.

2) BIDDING AND CONTRACT PROCESS INCLUDING CONTRACT COMPLIANCE PROGRAM

On February 12, 2007, under Roll Call Number 07-291, the Des Moines City Council approved bidding and contracting process changes for construction of public improvements. In accordance with the Initial Operating Contract with the City of Des Moines approved by the WRA Board under WRA Board Resolution Number 04-017, the City of Des Moines Engineering Department shall utilize its standard Bidding/Contracting Process for construction of WRA Improvements. The standard Bidding/Contracting Process included with said Roll Call 07-291 shall apply on this WRA project except of the following:

- The Change Order Process revisions shall not apply as the WRA Board has previously approved its own change order policy.
• The Equal Employment Opportunity (EEO) Program included in the Des Moines Contract Compliance Program shall apply to all WRA projects as state and federal law mandate these requirements; however, the Disadvantaged Business Enterprise/Targeted Small Business (DBE/TSB) Program shall not apply to projects funded solely with WRA funds. If federal or state funds include DBE or TSB requirements, these requirements will be included in those projects by special provision.

Said Roll Call 07-291 is available on the Engineering Department website at http://www.dm.gov/departments/ENG/Bid_Information/index.htm and includes an updated, revised Contract Compliance Program for the City of Des Moines, which is available at the same website.

3) ALTERNATE SALES AND USE TAX

Section 1020, 1.08, B, of the General Supplemental Specifications shall apply to this contract. The bidder should not include sales tax in the bid pursuant to Iowa Code. A sales tax exemption certificate will be available for all material purchased for incorporation in the project. Complete information on qualifying materials and supplies can be found at www.state.ia.us/tax, the Iowa Department of Revenue and Finance (IDRF) Web site. Links are found in the Business Taxes and Local Government categories. Contact the IDRF at idrf@idrf.state.ia.us if you have questions on this requirement.
The Jurisdiction will not purchase and maintain Builder's Risk Insurance on this project as referenced in the General Supplemental Specifications in Section 1070, 3.05A.2 (Builder's Risk Insurance by the Jurisdiction). The Contractor shall purchase and maintain an Installation Floater as referenced in the General Supplemental Specifications in Section 1070, 3.05A.3 (Installation Floater).
SPECIAL PROVISION
TECHNICAL SPECIFICATIONS

PROJECT MANUAL
FOR

BLENDED SLUDGE TANK MIXER REPLACEMENT

DES MOINES WASTEWATER RECLAMATION AUTHORITY

2022

OWNERSHIP OF DOCUMENT

This document, and the ideas and designs incorporated herein, as an instrument of professional service, is the property of HR Green, Inc. and is not to be used, in whole or in part, for any other project without the written authorization of HR Green, Inc.
# SPECIFICATIONS
## BLENDED SLUDGE TANK MIXER REPLACEMENT
### DES MOINES WASTEWATER
#### RECLAMATION AUTHORITY

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23 0719  HVAC Piping Insulations
23 0800  Commissioning of HVAC
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   B. Commencement of the Work.
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   E. Contractor Use of Site and Premises.
   F. Layout of the Work.
   G. Work Sequence.
   H. Permits, Fees and Notices.
   I. Safety and Protection

1.02 PROJECT INFORMATION
   A. Project Name: Blended Sludge Tank Mixer Replacement.
   B. Owner's Name: Des Moines Water Reclamation Authority.
      1. Contact Person: Patrick Brown, P.E.
      2. Address: 3000 Vandalia Road, Des Moines, Iowa 50317-8050.
      3. Telephone: (515) 323-8027.
      4. Fax: (515) 323-8050.
   C. Engineer's Name: HR Green, Inc.
      1. Contact Person: Mike Roth, P.E.
      2. Address: 5525 Merle Hay Road, Suite 200, Johnston, IA 50131-1448
      3. Phone: (515) 278-2913.
      4. Fax: (713) 965-0044.
   D. The Project consists of:
      1. Furnish all labor, materials, and equipment necessary for blended sludge tank mixer replacement including but not limited to the following: Removal of three (3) blended sludge tank mixers and all associated components; Installation of (12) vertical shaft mixers and associated controls; Replacement and/or addition of level transmitters; Related structural, electrical, and subsidiary work.
      2. Furnish all labor, materials, and equipment necessary for expansion of Building 70 electric room.

1.03 QUALITY ASSURANCE
   A. Supervision and Superintendent:
      1. The Contractor or competent Superintendent must be on the Project when construction activities are taking place. The Superintendent shall supervise, direct, and control the Contractor's operations, personnel, work and the Subcontractor's operations. The Contractor shall give the Owner and Engineer written notification of the name of the Superintendent. The Superintendent shall be employed by the General Contractor and shall be assigned to the project full-time. The Superintendent shall be incidental to mobilization. A copy of the Drawings and Specifications shall be available on the project site at all times.
      2. Contractor shall maintain a qualified and responsible person available 24 hours per day, seven days per week to respond to emergencies which may occur after hours. Contractor shall provide to Engineer the phone number and/or paging service of this individual.
      3. Incompetent or incorrigible employees shall be dismissed from Work by Contractor or its representative when requested by Engineer, and such persons shall not again be permitted to return to Work without written consent of Engineer.
1.04 COMMENCEMENT OF THE WORK
A. The Contractor shall not commence Work nor allow Subcontractors or Sub-subcontractors to commence Work until:
   1. The Agreement has been fully executed.
   2. The Owner has approved the Contractor’s Performance and Maintenance and Payment Bonds.
   3. The Owner has approved evidence of the Contractor’s Liability Insurance and other insurance required to be purchased by the Contractor.
   4. The Engineer, on behalf of the Owner, has issued a Notice to Proceed.

1.05 DESCRIPTION OF ALTERATIONS WORK
A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.
B. Owner will remove the following items before start of work:

1.06 OWNER OCCUPANCY
A. The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding the time for completing the entire work or such portions as may not have expired; but such taking, possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.
   1. If such prior use increases the cost of, or delays the Work, the Contractor shall be entitled to such extra compensation or extension of time, or both, as the Engineer may determine.
B. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
   1. Treatment plant must be maintained in operation throughout the entire construction period, with planned and scheduled shutdowns for connections, cut-ins, changeovers, etc.
C. Cooperate with Owner to minimize conflict and to facilitate Owner’s operations.
D. Schedule the Work to accommodate Owner occupancy and operations.
E. Continuity of treatment system operation.
   1. Conduct work in a manner that avoids interruption of effective treatment system operation.
   2. Prevent the bypass of untreated wastewaters to surface water or drainage ways.
      Accidental bypasses caused by Contractor’s work activity will entitle Owner to:
      a. Employ others to stop bypassing without giving notice to Contractor.
      b. Recover from the Contractor all costs incurred by the Owner as a result of the bypass, including labor, materials, services, legal fees, regulatory penalties, and other related expenses.
   3. Submit with the Construction Schedule a detailed outage plan and schedule for each system component. Indicate how effective wastewater system operation will be maintained.

1.07 CONTRACTOR USE OF SITE AND PREMISES
A. Construction Operations: Limited to areas noted on Drawings.
B. Work hours are 7:00 A.M. to 3:30 P.M., Monday-Friday unless prior approval obtained with the WRA.
C. Limit use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.
D. All City properties are tobacco free, and policy will be enforced.
E. Provide access to and from site as required by law and by Owner.
F. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

1.08 LAYOUT OF THE WORK
A. The Owner shall provide information to the Contractor regarding bench marks for the project. The Contractor shall be responsible for all detailed construction staking.
1.09 WORK SEQUENCE

A. Construct Work in stages to accommodate Owner's occupancy and operational requirements during the construction period. Coordinate construction schedule and operations with Owner with the following sequence to be generally followed:

1. Complete all required work separately for each blended sludge tank, including tank start-up and commissioning. At no time shall more than one (1) blended sludge tank be out of service. A tank shall be considered out of service if any construction or removals affect the operation of the tank including but not limited to: removal of level transmitters, removal of existing blended sludge mixers, and installation of new blended sludge mixers.

2. Contractor shall provide blended sludge tank(s) shut-down sequencing for Engineer and Owner review prior to commencing work. Contractor shall notify owner a minimum of one (1) week in advance of each blended sludge tank shut-down. Contractor shall coordinate with owner for tank shut-downs.

3. Prior to beginning work on a new tank, contractor shall have completed work on previous tank including start up and commissioning and obtained approval from owner to commence work on the next tank. Contractor shall have three (3) separate equipment start-ups scheduled with the mixer manufacturer (1 start-up for each tank). Contractor shall coordinate with owner for tank start-up.

4. The hauled waste tank may not be taken out of service. Contractor shall install new radar level transmitter 70-HW-LT-02 prior to removal of existing bubble level sensor and existing radar level transmitter.

5. Provide temporary cooling for electrical room while existing system is shut down for modification, and when existing equipment is temporarily removed to allow installation of new equipment. Temporary cooling will also be required for startup and testing of the new HVAC system which will require the existing system to be shut down. The electrical room is anticipated to require cooling regardless of the season.

B. All portions of work under the proposed Contract Documents shall be completed and ready for operation on or before the date set forth in the Notice of Hearing and Letting. Provisions for liquidated damages are set forth in the Agreement.

C. The Contractor shall schedule Work so that interruption of existing utilities, including but not limited to: electric, telephone, communication, cable, gas, water, and sewer service will be at a minimum. When it is necessary to interrupt services, the Contractor shall notify the Owner's representative, Engineer, and appropriate utility companies twenty-four (24) hours in advance of the interruption.

D. Plan the construction work and carry out with a minimum of interference with the operation of the existing facilities. Prior to starting the construction, confer with the Engineer and Owner's representative and develop a detailed, approved construction schedule which will permit the facilities to function as normally as practical during the construction period. It will be necessary to do certain parts of the construction work outside normal working hours and on Sundays in order to avoid undesirable conditions, and it shall be the obligation of the Contractor to do this work at such times at no additional cost to the Owner. Do not make connections between existing piping and new piping until necessary inspection and tests have been completed on the new work and it is found to conform in all respects to the requirements of the drawings and specifications.

E. Special notes detailing critical portions of the work involving removal, replacement, tie-in, changeover, etc. have been included in the drawings and the Work Sequence of this Section. These notes describe the work, timing, scheduling, and coordination with the Owner and Engineer necessary to complete the work. The detailed construction schedule shall be developed by the Contractor with consideration of these details and the overall progress of the work. The Engineer and Owner shall have full authority to review this schedule in order to protect the operation of the existing facilities during construction.

1.10 PERMITS, FEES AND NOTICES

A. The Contractor shall secure and pay for all permits and governmental fees, licenses and inspections for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which were legally required at the time bids were received.
1.11 SAFETY AND PROTECTION

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All persons on the Site or who may be affected by the Work;
2. All the work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
3. Other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor.

D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION 01 1000
SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS
A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS
A. Comply with requirements specified in Section 01 3000. No substitutions will be allowed during bidding.
B. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
E. Limit each request to a single proposed substitution item.

3.02 RESOLUTION

3.03 ACCEPTANCE
A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION 01 2500
SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preconstruction Meeting.
B. Progress Meetings.
D. Number of Copies of Submittals.
E. Submittal Procedures.

1.02 RELATED REQUIREMENTS
A. Section 01 1000 - Summary:
B. Section 01 3216 - CONSTRUCTION PROGRESS SCHEDULE: Form, content, and administration of schedules.
C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
D. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Design data.
   3. Shop drawings.
   4. Samples for selection.
   5. Samples for verification.
B. Submit for review according to the procedures and purposes described herein.
C. Samples will be reviewed for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.
E. Required Submittal Quality
   1. Binding
      a. No loose collection of papers bound by any type of paper clip/staple etc. accepted.
      b. 3/8" thickness (or less) of submittal material -- commercial grade reinforced paper/cardboard or plastic cover assembly.
      c. Greater than 3/8" but less than 1" thickness of submittal material -- commercial grade machine-bound wire or plastic multi-perforation binder.
      d. Greater than 1" -- commercial grade 3-ring binder.
   2. Organization
      a. Cover Labeling
         1) Supplier name, address, and telephone number.
         2) Supplier's designated Project Number.
         3) Engineer's designated Project Name, Job Number, and Location.
         4) Engineer's firm name and location
         5) General contractors name and location
         6) Specification Section(s) applicable to submittal contents.
      b. Contents
         1) Cover sheet (same as Exterior Cover requirements) with at least a 4" x 4" blank space for Engineers Review Stamp.
2) Table of Contents for all major equipment/devices/components/descriptions specified.
3) Notification of all exceptions taken to the specifications.
4) Order of Contents -- must be the same as order described in the applicable specification sections.
5) Tabs separating each major equipment division.
6) Colored fly sheets separating minor components.
7) All sheets to be 8-1/2 x 11 (minimum) or individually folded to achieve same dimension when larger sheets required.

3. Identification of Pertinent Information
   a. Provide Bill of Materials to indicate (at minimum) series, model number, and manufacturer.
   b. On catalog cut sheets:
      1) Identify series and complete model number proposed.
      2) Identify information pertinent to proposed model and conformance to specifications by arrow, underline, circular enclosure.
      3) Minimize non-specific information that does not indicate conformance or cross out non-pertinent information.
   c. On performance data/curves etc. clearly identify pertinent information (or cross out non-pertinent) data.
   d. On all documentation provided, illustrate exceptions to the contract documents.

4. Legible Quality
   a. Font size no less than 10; minimum character height no less than 1/16".
   b. No faxes accepted.
   c. No copies of catalog cuts accepted where information is skewed off page or non-linear.
   d. Basic information to be all typewritten; only identification of pertinent information may be hand written.

3.02 SUBMITTALS FOR INFORMATION
   A. When the following are specified in individual sections, submit them for information:
      1. Design data.
      2. Certificates.
      3. Test reports.
      4. Inspection reports.
      5. Manufacturer's instructions.
      6. Manufacturer's field reports.
      7. Other types indicated.
   B. Submit for Engineer's knowledge as contract administrator or for Owner.

3.03 SUBMITTALS FOR PROJECT CLOSEOUT
   A. Submit Correction Punch List for Substantial Completion.
   B. Submit Final Correction Punch List for Substantial Completion.
   C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
      1. Project record documents.
      2. Operation and maintenance data.
      3. Warranties.
      5. Other types as indicated.
   D. Submit for Owner's benefit during and after project completion.

3.04 NUMBER OF COPIES OF SUBMITTALS
   A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
   B. Documents for Review:
1. Submit the number of copies which the Contractor requires, plus one (1) copy which will be retained by the Engineer.

C. Documents for Information: Submit one copy.

D. Documents for Project Closeout: See Section 01 7800.

E. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.05 SUBMITTAL PROCEDURES

A. General Requirements:

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

C. Transmit each submittal electronically with a copy of approved submittal form.

D. Transmit each submittal with Contractor's standard submittal form.

E. Submittal number shall be in reference to Engineer's specification section. If there are multiple submittals to a singular specification section add a hyphen followed by a number. Re-submittals to have original number with an alphabetic suffix.
   1. Examples:
      a. Two submittals (from same specification section) for Project Review: 16 4250-1 & 16 4250-2; second submittal (after initial review was rejected): 16 4250-2-A.

F. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

G. Apply Contractor's standard certification stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without this certification will be returned without review.

H. Schedule submittals to expedite the Project, and deliver. Coordinate submission of related items.

I. Coordinate submittals with other submittals, related activities, sequential activities and overall performance of the Work.

J. For each submittal for review, allow 15 days excluding delivery time to and from contractor.

K. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed work.

L. Provide space for Contractor and Engineer review stamps.

M. Revise and submit submittals as required, identify all changes made since previous submittal.

N. When revised for resubmission, identify all changes made since previous submittal.

O. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

P. Clearly identify on the transmittal sheet if the submittal represents “Or Equal” items or substitute items. If the submittal is a substitute, the substitution must result in a decrease in overall cost or result in saving construction time.

Q. Contractor to investigate and evaluate for items with long lead times or critical path to execution of the contract, and to coordinate at least these items' submittal groupings with the Engineer. The Engineer accepts no burden for project delays where additional submittal cycles are required to ascertain conformance and intent to the contract documents.

R. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, give written notice thereof at least 7 calendar days prior to release.
S. When the shop drawings have been completed to the satisfaction of the Engineer, carry out the construction in accordance therewith and make no further changes therein except upon written instructions from the Engineer.

3.06 ENGINEER'S REVIEW RESPONSIBILITIES, PROCEDURES AND DEFINITIONS

A. General
1. Review of shop drawings, data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
   a. As permitting any departure from the Contract requirements;
   b. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
   c. As approving departures from details furnished by the Engineer, except as otherwise provided herein;
   d. As approving substitutions to specified products or manufacturers.
2. The Engineer does not review for verification of quantities, weights, dimensions, or means and methods.
3. Partial review status will not be given to a submittal. Entire submittal shall be either acceptable or the entire submittal must be resubmitted with corrections as clarified by status definitions below.
4. Submittals will be reviewed in order received unless Contractor requests a revised order of review, in writing. All submittals shall be submitted sufficiently in advance of construction requirements to provide no less than 15 calendar days for review from the time the Engineer receives them. No less than 30 calendar days will be required for major equipment that requires review by more than one engineering discipline.

B. All submittals that have been reviewed by Engineer will have Engineer's Review Stamp affixed, initialed and dated, indicating Engineer's review action. No submittals shall be used for construction unless they bear the initialed Engineer's Review Stamp. Possible review actions by Engineer are:
1. NO EXCEPTIONS NOTED. Engineer's review did not detect deviations from conformance and intent of the Contract Documents.
2. EXCEPTIONS NOTED. Engineer's review did not detect major deviations from conformance and intent of the contract documents; minor discrepancies and/or deficiencies are noted. Corrected copies are not required; however, the item(s) to be furnished are to be furnished in accordance with the Engineer's comments. If the Contractor elects to take exception to any comments, then corrected copies (with supplemental explanatory data) are to be re-submitted to the Engineer similar to a Revise and Resubmit status process.
3. REVISE AND RESUBMIT. Engineer's review found major discrepancies and/or deficiencies, and corrected submittals (in their entirety) are required to determine conformance and intent to the contract documents.
4. REJECTED. Engineer's review concluded that the item(s) submitted do not meet the requirements of the "Or Equal" allowance, or a "Substitution" has been provided without proper approval process. An additional submittal cycle is required containing suitable items to determine conformance and intent of the contract documents.
5. REVIEW NOT REQUIRED BY CONTRACT DOCUMENTS -- The Engineer's review found that the information submitted is not necessary to evaluate conformance and intent with contract documents.

3.07 RE-SUBMITTALS

A. Re-submittals will be handled in the same manner as first submittals. On re-submittals, direct specific attention, in writing on the transmittal letter and on re-submitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. Make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
B. Engineer will review all initial information for each submittal. Contractor shall reimburse Owner for the Engineer's charges for review of additional re-submittals. Contractor will be charged for review of all re-submittals over 20% of the initial submittals.
   1. EXAMPLE: If the Contractor has a total of 50 initial submittals, there will be no charge for reviewing a combined total of 60 submittals and re-submittals. There will be a charge to review all submittals and re-submittals in excess of 60.

C. The need for more than one re-submittal or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the contract time unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.

D. An assigned review status of REVISE AND RESUBMIT or REJECTED requires the original full number of submittals to be resubmitted free of the Engineers previous correction marks and review status stamp. The Engineer reserves the right to retain the same number of copies for each review cycle.

END OF SECTION 01 3000
SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1  GENERAL
1.01 SECTION INCLUDES
   A. Submittals.
   B. Preliminary schedule.
   C. Construction progress schedule, bar chart type.

1.02 SUBMITTALS
   A. Within 15 days after date of Agreement, submit initial progress schedule in duplicate defining
      planned operations for the first 60 days of Work, with a general outline for remainder of Work.
   B. If preliminary schedule requires revision after review, submit revised schedule within 15 days.
   C. Submit revised schedule with each Application for Payment, identifying changes since previous
      version.
   D. Show complete sequence of construction by activity, identifying Work of separate stages and
      other logically grouped activities. Indicate the early and late start, early and late finish, float
      dates, and duration.
   E. Indicate estimated percentage of completion for each item of Work at each submission.
   F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery
      dates.

1.03 SCHEDULE FORMAT
   A. Listings: In chronological order according to the start date for each activity. Identify each activity
      with the applicable specification section number.
   B. Scale and Spacing: To allow for notations and revisions.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION
3.01 PRELIMINARY SCHEDULE
   A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT
   A. Show complete sequence of construction by activity, with dates for beginning and completion of
      each element of construction.
   B. Identify each item by specification section number.
   C. Identify work of separate stages and other logically grouped activities.
   D. Provide sub-schedules to define critical portions of the entire schedule.
   E. Include conferences and meetings in schedule.
   F. Show accumulated percentage of completion of each item, and total percentage of Work
      completed, as of the first day of each month.
   G. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS
   A. Include a separate bar for each major portion of Work or operation.
   B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE
   A. Participate in joint review and evaluation of schedule with Resident Project Representative at
      each submittal.
   B. Evaluate project status to determine work behind schedule and work ahead of schedule.
C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE
   A. Maintain schedules to record actual start and finish dates of completed activities.
   B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
   C. Update diagrams to graphically depict current status of Work.
   D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
   E. Indicate changes required to maintain Date of Substantial Completion.
   F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE
   A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Engineer, Resident Project Representative, Owner, and other concerned parties.
   B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 3216
SECTION 01 4000
QUALITY REQUIREMENTS

PART 1  GENERAL

1.01  SECTION INCLUDES
   A. References and Standards.
   B. Field Samples.
   C. Testing Services.
   D. Control of installation.
   E. Tolerances.
   F. Manufacturers’ Field Services.

1.02  RELATED REQUIREMENTS
   A. Section 01 3000 - ADMINISTRATIVE REQUIREMENTS: Submittal procedures.

1.03  REFERENCES AND STANDARDS
   A. Conform to reference standard by date of issue current on date for receiving bids or date of
       Owner-Contractor Agreement when there are no bids.
   B. Obtain copies of standards where required by product specification sections.
   C. Maintain copy at project site during submittals, planning, and progress of the specific work, until
       Substantial Completion.

1.04  FIELD SAMPLES
   A. Install field samples at the site as required by individual specifications Sections for review.
   B. Acceptable samples represent a quality level for the Work.
   C. Where field sample is specified in individual Sections to be removed, clear area after field sample
      has been accepted by Engineer.

1.05  TESTING SERVICES
   A. Contractor shall employ and pay for services of an independent testing agency to perform tests
      and other testing and inspection specified in individual specification sections and as required by
      the Engineer.
   B. Owner may choose to have Engineer perform certain inspection and testing activities in addition
      to those specified as required by the Contractor. Payment for initial Owner/Engineer inspection
      and testing will be by Owner. Payment for Owner/Engineer retesting required because of non-
      conformance to specified requirements will be charged to the Contractor by deducting inspection
      and testing charges from the Contract Sum.
   C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance
      with requirements of Contract Documents.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01  CONTROL OF INSTALLATION
   A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and
      workmanship, to produce work of specified quality.
   B. Comply with manufacturers’ instructions, including each step in sequence.
   C. Should manufacturers’ instructions conflict with Contract Documents, request clarification from
      Engineer before proceeding.
   D. Comply with specified standards as minimum quality for the work except where more stringent
      tolerances, codes, or specified requirements indicate higher standards or more precise
      workmanship.
   E. Have work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   2. Perform inspections, sampling, testing, and other services specified in individual specification sections and as required by the Engineer.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Engineer and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Engineer.
   6. Submit reports of all tests/inspections specified to Engineer, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs, equipment, tools, storage, and assistance as requested.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Make arrangements with testing agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Engineer.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
G. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer. Payment for re-testing will be made by the Contractor.

3.04 MANUFACTURERS’ FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given by Manufacturer's Service Representatives to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Engineer for review.

D. Contractor shall provide qualified Service Representative(s), as necessary to:
   1. Instruct the Contractor's personnel in the installation, startup, and testing of equipment.
   2. Inspect equipment after it is installed to assure that all details of installation are correct and that equipment is prepared for operation in accordance with manufacturer's instructions and recommendations.
   3. Check connections to equipment and adjust, or supervise adjustment of, control and indicating devices after equipment has been installed and connected.
   4. Fully instruct Owner's operating personnel in operation and maintenance of equipment.
   5. Provide Engineer with duplicate copies of final alignment and clearance measurements on all rotating or reciprocating equipment. Measurements shall clearly identify each piece of equipment.

E. Presence of Service Representative will in no way relieve Contractor of any responsibility assumed under Agreement.

F. Work and abilities of Service Representative shall be subject to review of Engineer. If Engineer determines that any Service Representative is not properly qualified, Contractor shall replace Service Representative upon written notification by Engineer.

G. Contractor shall provide continuity in assignment of Service Representative to Work. In event substitution of Service Representative is made which is not at request of Engineer, substitute's time for "familiarization" shall be at Contractor's expense.

H. Execute manufacturer's certificate of proper installation, found at the end of this section.
QUALITY REQUIREMENTS

MANUFACTURER’S CERTIFICATE OF PROPER INSTALLATION

OWNER: ___________________________ EQPT. SERIAL NO: ___________________________

EQPT. TAG NO.: _____________________ EQPT./SYSTEM: ____________________________

PROJECT NO.: _____________________ SPEC. SECTION: ____________________________

I HEREBY CERTIFY THAT THE ABOVE-REFERENCED EQUIPMENT/SYSTEM HAS BEEN:
(CHECK APPLICABLE)

____ Installed in accordance with Manufacturer's recommendations.
____ Inspected, checked, and adjusted.
____ Serviced with proper initial lubricants.
____ Electrical and mechanical connections meet quality and safety standards.
____ All applicable safety equipment has been properly installed.
____ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer.)

COMMENTS:_____________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

I, THE UNDERSIGNED MANUFACTURER’S REPRESENTATIVE, HEREBY CERTIFY THAT I AM
(I) A DULY AUTHORIZED REPRESENTATIVE OF THE MANUFACTURER, (II) EMPOWERED BY
THE MANUFACTURER TO INSPECT, APPROVE, AND OPERATE HIS EQUIPMENT AND (III)
AUTHORIZED TO MAKE RECOMMENDATIONS REQUIRED TO ASSURE THAT THE
EQUIPMENT FURNISHED BY THE MANUFACTURER IS COMPLETE AND OPERATIONAL,
EXCEPT AS MAY BE OTHERWISE INDICATED HEREIN. I FURTHER CERTIFY THAT ALL
INFORMATION CONTAINED HEREIN IS TRUE AND ACCURATE.

DATE: _______________________________________________________________________

MANUFACTURER: ___________________________________________________________________

BY MANUFACTURER’S AUTHORIZED REPRESENTATIVE: ____________________________

(Authorized Signature)

END OF SECTION  01 4000
1.01 GENERAL
A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.02 ABBREVIATION
A. AAMA - Architectural Aluminum Manufacturer's Association
B. AASHTO - American Association of State Highway and Transportation Officials
C. AATCC - American Association of Textile Chemists and Colorists
D. ACI - American Concrete Institute
E. AFBMA - Anti-Friction Bearing Manufacturer's Association, Inc.
F. AGA - American Gas Association
G. AGMA - American Gear Manufacturer's Association
H. AI - The Asphalt Institute
I. AIA - American Institute of Architects
J. AISC - American Institute of Steel Construction
K. AISI - American Iron and Steel Institute
L. AITC - American Institute of Timber Construction
M. AMCA - Air Moving and Conditioning Association
N. ANS - American Nuclear Society
O. ANSI - American National Standards Institute, Inc.
P. APA - American Plywood Association
Q. API - American Petroleum Institute
R. APWA - American Public Works Association
S. ASA - Acoustical Society of America
T. ASAE - American Society of Agricultural Engineers
U. ASCE - American Society of Civil Engineers
V. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers
W. ASME - American Society of Mechanical Engineers
X. ASQC - American Society for Quality Control
Y. ASSE - American Society of Sanitary Engineers
Z. ASTM - American Society for Testing and Materials
AA. AWPA - American Wood Preservers Association
BB. AWPI - American Wood Preservers Institute
CC. AWS - American Welding Society
DD. AWWA - American Water Works Association
EE. BBC - Basic Building Code, Building Officials and Code Administrators International
FF. BHMA - Builders Hardware Manufacturer's Association
GG. CBM - Certified Ballast Manufacturers
HH. CEMA - Conveyors Equipment Manufacturer's Association
II. CGA - Compressed Gas Association
JJ. CMA - Concrete Masonry Association
KK. CRSI - Concrete Reinforcing Steel Institute
LL. EIA - Electronic Industries Association
MM. ETL - Electrical Test Laboratories
NN. EPA - Environmental Protection Agency
OO. FM - Factory Mutual System
PP. FPL - Forest Products Laboratory
QQ. HI - Hydronics Institute
RR. IAPMO - International Association of Plumbing and Mechanical Officials
SS. ICBO - International Conference of Building Officials
TT. IEEE - Institute of Electrical and Electronics Engineers
UU. IES - Illuminating Engineering Society
VV. IME - Institute of Makers of Explosives
WW. IP - Institute of Petroleum (London)
XX. IPC - Institute of Printed Circuits
YY. ISA - Instrument Society of America
ZZ. ISO - International Organization for Standardization
AAA. ITE - Institute of Traffic Engineers
BBB. MBMA - Metal Building Manufacturer's Association
CCC. MPTA - Mechanical Power Transmission Association
DDD. MSS - Manufacturing Standardization Society
EEE. NAAMM - National Association of Architectural Metal Manufacturer's
FFF. NACE - National Association of Corrosion Engineers
GGG. NBS - National Bureau of Standards
HHH. NEC - National Electrical Code
III. NEMA - National Electrical Manufacturer's Association
JJJ. NFPA - National Fire Protection Association
KKK. NFPA - National Forest Products Association
LLL. NLGI - National Lubricating Grease Institute
MMM. NMA - National Microfilm Association
NNN. NSF - National Sanitation Foundation
OOO. NWMA - National Woodwork Manufacturers Association
PPP. OSHA - Occupational Safety and Health Administration
QQQ. PCA - Portland Cement Association
RRR. PPI - Plastics Pipe Institute
SSS. RCRA - Resource Conservation and Recovery Act
TTT. RVIA - Recreational Vehicle Industry Association
UUU. RWMA - Resistance Welder Manufacturer's Association
VVV. SAE - Society of Automotive Engineers
WWW. SAMA - Scientific Apparatus Makers Association
XXX. SMA - Screen Manufacturers Association
YYY. SMACCNA - Sheet Metal and Air Conditioning Contractors National Association
ZZZ. SPI - Society of the Plastics Industry, Inc.
AAAA. SPIB - Southern Pine Inspection Bureau
BBBB. SPR - Simplified Practice Recommendation
CCCC. SSBC - Southern Standard Building Code, Southern Building Code Congress
DDDD. SSPC - Steel Structures Painting Council
EEEE. SSPWC - Standard Specifications for Public Works Construction
FFFF. UBC - Uniform Building Code
GGGG. UL - Underwriters Laboratories, Inc.
HHHH. WCLIB - West Coast Lumber Inspection Bureau
III. WCRSI - Western Concrete Reinforcing Steel Institute
JJJJ. WEF - Water Environment Federation
KKKK. WIC - Woodwork Institute of California
LLLL. WRI - Wire Reinforcement Institute, Inc.
MMMM. WWPA - Western Wood Products Association

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION 01 4213
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PART 1 GENERAL

1.01 GENERAL

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. Specialists, Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the documents listed in Part 2.

B. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

C. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

1.03 QUALITY ASSURANCE

A. The Contractor shall construct Work specified herein by reference to the Contract Document and the referenced portions of those referenced codes, standards, and specifications listed herein.

B. Should specified code, reference standards or drawings conflict with Contract Documents, the most stringent requirements shall govern. Request clarification from the Engineer before proceeding. The Contractor shall bid for the most stringent requirements.

C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Engineer shall be altered by Contract Documents by mention or inference otherwise in any reference document.

1.04 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The Contractor is responsible that all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.

B. Where no specific regulations exist, all chemical, hazardous, and petroleum product piping and storage in underground locations must be installed with double containment piping and tanks, or in separate concrete trenches and vaults, or with an approved lining which cannot be penetrated.
REFERENCE STANDARDS

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
2.02 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL
2.03 ADA -- AMERICAN DISABILITIES ACT
2.04 AGC -- ASSOCIATED GENERAL CONTRACTORS OF AMERICA
2.05 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE
2.06 ASTM A SERIES -- ASTM INTERNATIONAL
2.07 AWS -- AMERICAN WELDING SOCIETY
2.08 AWWA -- AMERICAN WATER WORKS ASSOCIATION
2.09 FS -- FEDERAL SPECIFICATIONS
2.10 IOWA OCCUPATIONAL SAFETY AND HEALTH ACT OF 1972
2.11 NEC -- NATIONAL ELECTRICAL CODE
2.12 NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
2.13 NESC - NATIONAL ELECTRICAL SAFETY CODE
2.14 OTHER STANDARDS AND CODES WHICH MAY BE APPLICABLE TO ACCEPTABLE STANDARDS OF THE INDUSTRY FOR EQUIPMENT, MATERIALS, AND INSTALLATION UNDER THE CONTRACT.

END OF SECTION 01 4219
**SECTION 01 5000**

**TEMPORARY FACILITIES AND CONTROLS**

**PART 1  GENERAL**

1.01 SECTION INCLUDES

A. Temporary Utilities.
B. Temporary telecommunications services.
C. Temporary Water Service.
D. Temporary Sanitary Facilities.
E. Water Control.
F. Protection of Installed Work.
G. Security Requirements.
H. Vehicular Access and Parking.

1.02 TEMPORARY UTILITIES

A. Contractor shall provide and pay for all ventilation required for construction purposes.
B. Provide all electrical power required for construction purposes. There will be no cost to the Contractor for electricity used.
C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TEMPORARY HEAT

A. Contractor shall provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.

1.04 TEMPORARY TELEPHONE SERVICE

A. Telecommunications services shall include:
B. Provide, maintain, and pay for mobile phone service for the field superintendent or other Contractor field representative.
C. A cellular phone shall be acceptable as temporary phone service. Provide phone number to Engineer and Owner.

1.05 TEMPORARY WATER SERVICE

A. Make suitable arrangements for temporary water service if water is needed for construction or testing. There will be no cost to the Contractor for water used.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures for Contractor’s workers, Engineer’s personnel, Owner’s personnel and testing firm personnel working at project site. Provide at time of project mobilization.
B. Portable toilets shall be acceptable. Comply with all applicable codes and regulations. Arrange for regular cleaning and/or replacement of portable toilets.
C. Maintain daily in clean and sanitary condition.

1.07 WATER CONTROL

A. Conform to the regulations and requirements of legally authorized surface water management agencies.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Conduct operations in such a manner to prevent sediment from reaching existing sewers and storm drains.
D. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
HR Green, Inc.
Project No. 201303

Blended Sludge Mixer Improvements
Wastewater Reclamation Authority
Des Moines, Iowa

E. Cover exposed excavated areas and spoil piles when runoff from rain is likely to cause turbidity to enter local waterways. Suspend work in the rain if such work cannot be performed without causing turbid runoff.
F. Prevent solids or turbid runoff from entering local waterways. Cover, secure and/or berm excavated area and spoil piles.
G. Where necessary, divert stream through closed pipe system to minimize downstream erosion, sedimentation, and turbidity during construction.

1.08 PROTECTION OF INSTALLED WORK
A. Protect installed Work and provide special protection where specified in individual specification Sections.

1.09 INTERIOR ENCLOSURES
A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 SECURITY
A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING
A. Maintain existing roads.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
D. Provide and maintain access to fire hydrants, free of obstructions.
E. Provide means of removing mud from vehicle wheels before entering streets.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000
SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Submittals.
B. Warranty.
C. Re-use of Existing Products.
D. Transportation, handling, storage and protection.
E. Product Option Requirements.
F. Substitution Limitations and Procedures.
G. Procedures for Owner-Supplied Products.
H. Spare Parts and Maintenance Materials.

1.02  SUBMITTALS
A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   1. After review, distribute in accordance with Article on Procedure above and for Record Documents described in Section 01 7800.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
   2. Include identification on each sample, with full Project information.
   3. Submit two samples as specified in individual specification Sections; one of which will be retained by Engineer.
   4. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

1.03  WARRANTY
A. All Products as defined below shall be provided with manufacturer's full warranty against defects in materials and workmanship for two years after Date of Substantial Completion, including all parts, labor, and expenses, unless otherwise required in individual specification Sections.
   1. This manufacturer's warranty shall be in addition to the Contractor's guarantee secured by the Performance and Maintenance Bond - Section 00610.

PART 2  PRODUCTS

2.01  PRODUCTS
A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
2.02 NEW PRODUCTS
   A. Provide new products unless specifically required or permitted by Contract Documents.
   B. Use of products having any of the following characteristics is not permitted:
   C. Where other criteria are met, Contractor shall give preference to products that:
      1. If used on interior, have lower emissions.
      2. If wet-applied, have lower VOC content.

2.03 PRODUCT OPTIONS
   A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
   B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
   C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS
   A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
   B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION
3.01 SUBSTITUTION LIMITATIONS
   A. See Section 01 2500 - Substitution Procedures.
   B. A request for substitution constitutes a representation that the submitter:
      1. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

3.02 OWNER-SUPPLIED PRODUCTS
   A. Owner's Responsibilities:
      1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
      2. Arrange and pay for product delivery to site.
      3. On delivery, inspect products jointly with Contractor.
      4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
      5. Arrange for manufacturers' warranties, inspections, and service.
   B. Contractor's Responsibilities:
      1. Review Owner reviewed shop drawings, product data, and samples.
      2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
      3. Handle, store, install and finish products.
      4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING
   A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
   B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
   C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
   D. Transport and handle products in accordance with manufacturer's instructions.
   E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
   1. Contractor shall be paid for materials and equipment stored off-site, upon proper documentation of delivery, control and protection of said materials and equipment. Contractor's insurance shall be in full force at this off-site location for complete protection of said materials and equipment.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000
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PART 1  GENERAL

1.01  SECTION INCLUDES
A. Submittals.
B. Coordination
C. Examination, Preparation, and General Installation Procedures.
D. Requirements for alterations work, including selective demolition.
E. Cutting and Patching.
F. Alterations.
G. Laying Out the Work.
H. Progress Cleaning.
I. Starting Systems.
J. Demonstration and Instruction.
K. Closeout Procedures.

1.02  SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather-exposed or moisture-resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   5. Work of Owner or separate Contractor.

1.03  PROJECT CONDITIONS
A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Minimize dust nuisance by cleaning, sweeping, vacuum sweeping, sprinkling with water, or other means. The use of water in amounts that result in mud on public streets or roads is not an acceptable substitute for sweeping. Equipment for this operation shall be available at all times.
C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as silt fences, filter fabric, sedimentation ponds, placement berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Restrict construction involving noisy operations, including starting and warming up of equipment, to the hours between 7:00 a.m. and 8:00 p.m. on weekdays. The exception to this requirement includes the need to operate equipment for temporary wastewater pumping.
   2. Each internal combustion engine, used for any purpose on the job or related to the job, shall be enclosed and be equipped with a muffler of a type recommended by the manufacturer.
EXECUTION AND CLOSEOUT REQUIREMENTS

No internal combustion engine shall be operated on the project without muffler and enclosure.

1.04 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Coordinate completion and clean-up of work of separate sections.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

PART 3 EXECUTION

3.01 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Contractor shall locate and protect survey control and reference points.

C. Control datum for survey is that established by Owner provided survey.

D. Utilize recognized engineering survey practices.

E. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

C. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

D. Materials: As specified in product Section; match existing products and work for patching and extending work.

E. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

F. Remove, cut, and patch work in a manner to minimize damage and to provide a means of restoring products and finishes to original condition.

G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.03 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
EXECUTION AND CLOSEOUT REQUIREMENTS

1. Remove items indicated on drawings.
2. Relocate items indicated on drawings.
3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

G. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Engineer review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

J. Finish surfaces as specified in individual product Sections.

K. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
   1. Patch as specified for patching new work.

L. Clean existing systems and equipment.
M. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

N. Do not begin new construction in alterations areas before demolition is complete.

O. Comply with all other applicable requirements of this section.

3.04 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute cutting, fitting, and patching, including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

J. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

M. Identify any hazardous substance or condition exposed during the Work to the Engineer for decision or remedy.

3.05 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
C. After painting begins or permanent heating system is started, use vacuum cleaning in lieu of broom cleaning methods.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and properly dispose off-site; do not burn or bury.

3.06 SYSTEM STARTUP
A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Engineer and Owner seven days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report in accordance with Section 01 4000 that equipment or system has been properly installed and is functioning correctly.
I. Perform subsequent testing, adjusting, and balancing of equipment and systems as required to provide operation according to the manufacturer's recommendations and the Contract Documents.

3.07 DEMONSTRATION AND INSTRUCTION
A. Demonstrate operation and maintenance of products to Owner's personnel prior to date of Substantial Completion.
B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.
C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.08 CLOSEOUT PROCEDURES
A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer.
B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
C. Notify Engineer when work is considered ready for Final Completion.
D. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
E. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
F. Submit Contractor's Statement listing all State where project is located (Iowa) sales/use taxes, waivers of liens from all Subcontractors and suppliers, and other items required by the Contract Documents.
G. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.

END OF SECTION 01 7000
SECTION 01 7413
CLEANING

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Cleaning during progress and at the completion of the Work as required by General Conditions.

1.02 DISPOSAL REQUIREMENTS
A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

1.03 RESPONSIBILITIES AND COORDINATION BETWEEN PRIME CONTRACTORS
A. Contractor is responsible for cleaning their own installed materials and equipment, both during and at the completion of construction. Each Contractor is responsible for removing and disposing waste, rubbish, and debris off the site in an approved landfill area.
B. If Contractor fails to clean exposed surfaces and/or remove debris from site, the Owner may clean up and charge the cost to the Contractor responsible as the Owner determines to be just.
C. Contractor is responsible for final cleaning of floors, walks, and grounds.

PART 2 PRODUCTS
2.01 MATERIALS
A. Contractor to provide all equipment required to complete cleaning.
B. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
C. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
D. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION
3.01 DURING CONSTRUCTION
A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
B. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas away from the site.
C. After painting begins or permanent heating system is started, use vacuum cleaning in lieu of broom cleaning methods.

3.02 FINAL CLEANING
A. In addition to the requirements for clean-up as specified in the General Conditions, the Contractor shall remove to the Owner's satisfaction, all asphalt or concrete spilled on or around the buildings. Dispose of all rubbish and debris from the site in an approved landfill area.
B. Employ skilled workmen for final cleaning.
C. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
D. Wash and shine glazing and mirrors.
E. Polish glossy surfaces to a clear shine.
F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
G. Prior to final completion, or Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas to verify that the entire work is clean.

END OF SECTION 01 7413
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SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Project Record Documents.
B. Operation and Maintenance Data.
C. Instruction of Owner's Personnel.
D. Warranties and Bonds.

1.02 RELATED REQUIREMENTS
A. Section 01 3000 - ADMINISTRATIVE REQUIREMENTS: Submittals procedures, shop drawings, product data, and samples.
B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
C. Individual Product Sections: Specific requirements for operation and maintenance data.
D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS
A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.
   1. Submit two (2) hard copies and one (1) electronic copy of final shop submittals.
B. Operation and Maintenance Data:
   1. Submit two (2) copies of preliminary draft hard copies (paper) or proposed formats and outlines of contents before start of Work. Submit one (1) copy of preliminary electronic format before start of work. Engineer will review draft and return one copy with comments.
   2. Submit three copies of approved data in final form prior to final inspection or acceptance. Two (2) hard copies and one (1) electronic copy.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. Equipment Data Forms: Complete attached data form for all installed work prior to application of final payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
B. Store record documents separate from documents used for construction.
C. Record information concurrent with construction progress.
D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.
E. Submit documents to Engineer prior to claim for final Application for Payment.

3.02 OPERATION AND MAINTENANCE DATA
A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data for particular installation. Organize in consistent format under separate headings for different procedures. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
E. Copy of each warranty, Bond, and service contract issued. Provide information sheet for Owner's personnel, giving proper procedures in event of failure and instances which might affect validity of warranties or Bonds.

3.03 INSTRUCTION OF OWNER'S PERSONNEL
A. Three (3) separate training sessions over two (2) separate days shall be coordinated with the owner after start-up of the first completed blended sludge tank.
B. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.
C. Manual for equipment and systems shall constitute basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.
D. Any presentation or training materials shall be provided to the Owner in format presented (i.e. Microsoft format, version 2007 or less).

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS
A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.
B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
E. Provide servicing and lubrication schedule, and list of lubricants required.
F. Include manufacturer's printed operation and maintenance instructions.
G. Include sequence of operation by controls manufacturer.
H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance. Include predicted life of parts subject to wear and list of items recommended to be stocked as spare parts.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

M. Content for each electrical and electronic system, as appropriate.
   1. Description of system and component parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and commercial number of replacement parts.
   2. Circuit directories of panel boards:
      a. Electrical service.
      b. Controls.
      c. Communications.
   3. As-installed color coded wiring diagrams.
   4. Operating procedures:
      a. Routine and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   5. Maintenance procedures:
      a. Routine operations.
      b. Guide to "trouble-shooting".
      c. Disassembly, repair, and assembly.
      d. Adjustment and checking.
   6. Manufacturer's printed operating and maintenance instructions.
   7. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Prepare and include additional data when need for such data becomes apparent during instruction of Owner's personnel.

O. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS (HARD COPIES - PAPER)

A. Prepare instructions and data by personnel:
   1. Trained and experienced in maintenance and operation of described products.
   2. Familiar with requirements of this section.
   3. Skilled as technical writers to extent required to communicate essential data.
   4. Skilled as draftsmen competent to prepare required drawings.

B. Prepare data in the form of an instructional manual for use by Owner's personnel.

C. Format: 8-1/2 x 11 inch paper with 20 lb. minimum, white, for typed pages.

D. Binders: Commercial quality, 8-1/2 by 11 inch binders with durable and cleanable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify: title of Project, identity of separate structure as applicable, and identity of general subject matter covered in manual.

F. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major
component parts of equipment.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Contents: Neatly typewritten table of contents for each volume, arranged in systematic order with consecutive page numbers.
   1. Contractor, name of responsible principal, address, and telephone number.
   2. List of each product required to be included, indexed to content of volume.
   3. List, with each product, name, address, and telephone number of:
      a. Subcontractor or installer.
      b. Maintenance contractor, as appropriate.
      c. Identify area of responsibility of each.
      d. Local source of supply for parts and replacement and list of recommended spare parts.
   4. Identify each product by product name and other identifying symbols as set forth in Contract documents, including nameplate information and shop order numbers for each item of equipment furnished.
   5. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
   6. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

I. Provide 30 days prior to actual start-up.

3.06 OPERATION AND MAINTENANCE MANUALS (ELECTRONIC)
   A. Prepare instructions and data by personnel:
      1. Trained and experienced in maintenance and operation of described products.
      2. Familiar with requirements of this section.
      3. Skilled as technical writers to extent required to communicate essential data.
      4. Skilled as draftsmen competent to prepare required drawings.
   B. Prepare data in the form of an instructional manual for use by Owner's personnel.
   C. Format: Electronic copy shall be delivered on a unique CD-ROM in Adobe Acrobat's Portable Document Format (PDF) and Microsoft Word versions. The PDF file(s) shall be fully indexed using the table of contents, searchable with thumbnails generated. The Microsoft Word files shall be easily found using unique file naming conventions with reference list.

3.07 WARRANTIES AND BONDS
   A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Completion is determined.
   B. Verify that documents are in proper form, contain full information, and are notarized.
   C. Co-execute submittals when required.
   D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 01 7800
Equipment Data Form

Project Name: _____________________________________________________
Contractor: _________________________________________________________
Equipment No: _______________________________________________________
Description: _________________________________________________________
Location: ____________________________________________________________
Manufacturer: _________________________________________________________
Purchased from: _______________________________________________________
Date of Purchase: ______________________________________________________
Local Supplier: _________________________________________________________
Address: _____________________________________________________________
Phone Number: _________________________________________________________
Number of Units: ___________________________ Serial Number: __________________
Cost of Individual Unit: $________________________

Valves

Type of Valve: __________________________
Manufacturer: __________________________
Size: __________________________
Operator: ( ) Manual Wrench
( ) Manual Chain
( ) Electric Actuator
    Manufacturer: __________________________
    Model: __________________________
    Serial: __________________________
    Ratio: __________________________
    Voltage: __________________________
# Equipment Data Form

Project Name: _____________________________________________________
Contractor: _______________________________________________________
Equipment No: ____________________________
Description: _______________________________________________________
Location: __________________________________________________________________
Manufacturer: _______________________________________________________
Purchased from: __________________________________________________________________
Date of Purchase: _______________________________________________________
Local Supplier: __________________________________________________________________
Address: __________________________________________________________________
Phone Number: __________________________________________________________________
Number of Units: __________ Serial Number: __________
Cost of Individual Unit: $__________

### Electric Motor

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<tr>
<td>Frame:</td>
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<tr>
<td>Model:</td>
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### Pump or HVAC Unit

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### Control Panel

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**Equipment No.**

**Description**

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<th>Frequency:</th>
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<tr>
<td>List briefly each maintenance operation required and refer to specific information in Manufacturer’s Manual, if applicable. Refer to Lubricant List for Lubrication Operation.</td>
<td>List required frequency of each Maintenance operation.</td>
</tr>
</tbody>
</table>
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PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Selective demolition of building elements for alteration purposes.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
   B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
      1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
      2. Identify interruption to plant flow or utility services.
      3. Identify demolition firm and submit qualifications.
      4. Include a summary of safety procedures.
      5. Identify locations of temporary protection and means of egress.
   C. Inventory: After demolition is complete, submit a list of items that have been removed and salvaged.
   D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.04  DEFINITIONS
   A. Demolish/Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.
   B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
   C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.05  MATERIALS OWNERSHIP
   A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, [Insert description of other items,] antiques, and other items of interest or value to Owner that may be encountered during building demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.06  QUALITY ASSURANCE
   A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
   B. Standards: Comply with ANSI A10.6 and NFPA 241.
   C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to building demolition including, but not limited to, the following:
      1. Inspect and discuss condition of construction to be demolished.
      2. Review structural load limitations of existing structures.
      3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
      4. Review and finalize protection requirements.

1.07  REGULATORY REQUIREMENTS
   A. Conform to applicable city, county, state, and federal codes for demolition work, disposal of debris, dust control, products requiring electrical disconnection and re-connection.
1.08 PROJECT CONDITIONS

A. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

B. Comply with other requirements specified in Section 01 7000.

C. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

D. Owner will occupy another building immediately adjacent to demolition area. Conduct building demolition so Owner's operations will not be disrupted.
   1. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
   2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.
      a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

E. Owner assumes no responsibility for buildings and structures to be demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

F. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

G. Perform demolition operations in manner that in no way endangers personnel, public, existing structures, utilities, roadways, or facilities not to be demolished. If damages do occur, the Contractor will be held responsible and shall repair or replace any damage at no additional cost to Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Do not use explosives on this Work.

PART 3 EXECUTION

3.01 SCOPE

A. Remove items indicated on the Drawings, for salvage, relocation, and recycling.

3.02 EXAMINATION

A. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

B. Inventory and record the condition of items to be removed and salvaged.

C. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Engineer.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.03 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
2. Comply with applicable requirements of NFPA 241.
3. Use of explosives is not permitted.
4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. Do not close or obstruct roadways or sidewalks without permit.
8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.
D. Do not begin removal until built elements to be salvaged or relocated have been removed.
E. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.
F. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
G. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.04 EXISTING UTILITIES
A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
   1. Utility locations shown on the Plans should be considered approximate and may not be complete. Field verify all utility locations.
   2. Notice provided to each utility sufficiently in advance of such operations to allow the utility time to mark the location of, relocate, adjust, or otherwise protect their facilities. Reach an agreement with each utility on appropriate action necessary to protect or relocate the utility facilities. The cost of such action to protect the facilities, except for locates, shall be borne by the Contractor. Utilize Digger's Hotline (800-242-8511) for locates for those utilities which subscribe to this service.
   3. At all times conduct operations so that necessary clearances are maintained and said utility facilities are protected. Comply with all Local, State, and Federal, or other regulations in performing work near utility facilities.
   4. Should the Contractor damage any of the utility facilities during Contractor's operations or determine the work cannot be performed safely, the Contractor shall immediately notify the utility involved and cease work until arrangements are made to prevent further damage or a serious accident. The Owner is not responsible for the cost of any damage, including disruption of service, to any utility facility resulting from Contractor's operation.
   5. Failure of the Contractor to provide timely notice to the utility or to conduct operations in such manner that proper clearances are maintained and the utility facilities are protected at all times will be grounds for the issuance of a Stop Work Order.

B. Protect existing utilities to remain from damage.
C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Mark location and termination of utilities.

H. Disconnect, remove, cap, and identify designated utilities within demolition areas.

I. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

J. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

K. Where there exists the potential for a conflict between the proposed line with an existing utility line, locate and expose any utility in advance of the proposed construction so determinations as to the required adjustments can be made.

3.05 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Engineer before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications):
   Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 01 1000 for other limitations on outages and required notifications.
   4. Verify that abandoned services serve only abandoned facilities before removal.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Removed and Salvaged Items:
   1. Clean salvaged items of dirt and demolition debris.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area on-site.
   5. Protect items from damage during transport and storage.

G. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.06 MECHANICAL DEMOLITION

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact or dust generation.

C. Concrete: Cut concrete full depth at junctures with construction indicated to remain, using power-driven saw, then remove concrete between saw cuts.

D. Masonry: Cut masonry at junctures with construction indicated to remain, using power-driven saw, then remove masonry between saw cuts.

E. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove.

F. Structural Steel: Dismantle field connections without bending or damaging steel members. Do not use flame-cutting torches unless otherwise authorized by Engineer.

3.07 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

3.08 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by building demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.09 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02 4100
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PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete formwork.
B. Elevated concrete slabs.
C. Concrete reinforcement.
D. Anchors and Inserts.
E. Grout.
F. Testing concrete.
G. Concrete used in the construction of utility structures, sidewalks, and miscellaneous structures.
H. Concrete curing.

1.02 REFERENCE STANDARDS
C. ACI 301 - Specifications for Concrete Construction.
D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
G. ACI 308R - Guide to External Curing of Concrete.
H. ACI 318 - Building Code Requirements for Structural Concrete.
M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
N. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
W. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
1.03 DEFINITIONS
A. Defective Areas: Surface defects that include honeycomb, rock pockets, cracks 0.005 inch wide and larger, cracks that leak in water-holding basins, spalls, chips, embedded debris, sand lines, bleed lines, leakage from form joints, fins and other projections, and form popouts.
B. Qualified Mix Designer:
   1. Iowa-registered professional engineer experienced in concrete mix design or
C. New Concrete: Less than 60 days old.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.
B. Shop Drawing:
   1. Product Data:
   2. Design Data: Concrete mix designs signed by qualified mix designer.
   3. Gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve size.
   4. Curing methods proposed.
   5. Detailed plan for cold weather curing and protection of concrete placed and cured in weather below 40 degrees F.
   6. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
   7. Detailed plan for repair and patching of defective concrete areas.
C. Concrete Mixes: Submit 30 days (minimum) prior to first scheduled concrete use.
   1. Summary Letter, certified by Mix Designer
      a. Mix design summary letter from Mix Designer, including all of the following information for each concrete mix in the Project in tabular form:
         1) Concrete Mix Designation that will appear on Delivery Ticket.
         2) Name and location of ready mix plant(s) supplying this mix.
         3) Design F’c, slump and air content for this mix.
         4) Standard deviation of ready mix plant(s) used in calculation of F’cr for this mix, if applicable.
         5) Indicate whether mix design is based on “trial batches” or “field experience”.
         6) F’cr for this mix.
   2. Mix Designs
      a. For each Mix Designation identified in summary letter, submit:
         1) Mix design following ACI flow chart procedure.
         2) Weight and volume of all mix ingredients, including brand and type, if applicable.
         3) Water/cementitious ratio clearly identified.
         4) Coarse aggregate size designation, corresponding to a gradation submitted under paragraph above.
         5) Slump.
         6) Air content.
7) Compressive strength test results used to generate standard deviation for mix, if applicable.
8) F'cr for mix.
9) Compressive strength test results verifying that mix meets F'cr:
   (a) Trial batch test results or
   (b) Test results for similar mix “field experience”.

D. Quality Control:
1. Manufacturer’s application instructions for bonding agent.
2. Proposed application schedule and instructions for patching materials.
3. Manufacturers’ Certificate of Compliance:
   a. Portland cement.
   b. Admixtures.
   c. Fly ash.
   d. Aggregates.
   e. Bonding agent.
   f. Patching materials.
4. Admixtures: Manufacturers’ Certificate of Proper Usage and certification that all admixtures are compatible with each other and the aggregates.
5. Statements of Qualification:
   a. Mix designer.
   b. Batch plant.
6. Test Reports:
   a. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture and fly ash and cement.
   b. Source test analysis report for fly ash.
   c. Statement identifying aggregates reactivity and aggregate effects on concrete finish and appearance.
7. Concrete Delivery Tickets. Submit certified copy of ticket for each load of concrete delivered to site. Hand to Owner’s representative immediately upon arriving at job site. Include on ticket:
   a. Name and location of batch plant and name of plant representative.
   b. Ticket number.
   c. Load number (batch number).
   d. Date and truck number.
   e. Destination of concrete in the Work (identified by elevation, grid, etc.).
   f. Concrete type and class (strength) and Mix Designation.
   g. Amount of concrete in cubic yards.
   h. Time at which mixer drum was charged with cement.
   i. Type, brand, and amount of cement.
   j. Class, brand, and amount of fly ash.
   k. Type, brand, and amount of each admixture added at plant.
   l. Type, brand, and amount of fiber reinforcement.
   m. Source and amount of each metered or weighed water added at plant.
   n. Information necessary to calculate the total mixing water. Total mixing water includes free water on aggregates, batch water (metered or weighed) including ice batched at the plant, and wash water retained in the mixing drum.
      1) Aggregate moisture must be measured not less than once per day.
   o. Maximum size of aggregate.
   p. Mass (amount) of fine and coarse aggregate.
   q. Actual water/cementitious ratio of load as it left batch plant.
   r. Signature or initials of plant representative.
   s. Amount of any materials added to drum after truck left batch plant; time at which additional materials were added; and reading of revolution counter.
   t. Time of arrival of truck on site.
   u. Time at which concrete unloading began, and reading of revolution counter.
v. Time at which concrete unloading was completed.
w. If job-site testing is done on any concrete from load, identify test number for cross-referencing.
x. If superplasticizer is added at site, record slump before and after addition of superplasticizer. Record time and/or drum revolutions as necessary to show that mixing complied with superplasticizer manufacturer's recommendations.

E. Test Reports: Submit report for each test or series of tests specified.

F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301, ACI 318, and ACI 117.  
   1. Maintain one copy of each document on site.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Preinstallation Meetings:
   1. Required Meeting Attendees:
      a. Contractor.
      b. Ready-mix producer.
      c. Admixture representative.
      d. Engineer.
      e. Testing Agency.
   2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
   3. Agenda shall include:
      a. Admixture types, dosage, performance, and redosing at site.
      b. Mix designs, test of mixes, and Submittals.
      c. Placement methods, techniques, equipment, consolidation, and form pressures.
      d. Slump and placement time to maintain slump.
      e. Finish, curing, and water retention.
      f. Discussion of formwork design requirements.
      g. Other specified requirements requiring coordination.
   4. Provide meeting minutes as specified in Division 1.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

3. Provide stainless steel, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering and interior wastewater tank surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I - Normal or Type II - Moderate Portland type. Tricalcium aluminate content of Type I Cement shall not exceed 12 percent.
   1. Acquire cement for entire project from same source.

B. Epoxy Polymer Concrete
   1. Unitex by Dayton Superior PRO-POXY 2000 or Engineer approved equivalent.
   2. Compressive strength, 12000 PSI.
   3. Follow manufacturer's instructions for composition, mixing, application, and curing.

C. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Natural Aggregates:
      a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
      b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
   4. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.

D. Pozzolan (Fly Ash): ASTM C 618, Class C or F, per Table 1 and 2, except as modified herein:
   1. Loss on Ignition: Maximum 3 percent.
   2. Water Requirement: Maximum 100 percent of control.
   3. ASTM C618, Table 1A, apply when aggregates or portion of coarse or fine aggregates used are reactive as specified under paragraph Aggregates.
   4. ASTM C618, Table 2A, Reactivity with Cement Alkalies, apply when aggregates or portions of aggregates are reactive as specified under paragraph Aggregates.
   5. ASTM C618, Table 2A, Uniformity Requirements, apply when loss on ignition of fly ash furnished exceeds 3 percent.

E. Water: ASTM C1602/C1602M.

F. Synthetic fibers: fibrillated nylon or polypropylene.
   1. ASTM C1116/C1116M, Type III.
   2. Dosage: Minimum 1.5 LB/cubic yard.
   3. Manufacturers:
      a. Propex - Fibermesh 300.
      b. Grace - Grace Fibers.
      c. Euclid Chemical Co. - Fiberstrand F.
      d. GRT - Polymesh.
2.04 ADMIXTURES

A. Characteristics: Compatible with each other and free of chlorides or other corrosive chemicals.

B. All admixtures shall be supplied from the same manufacturer and used in accordance with the manufacturer's recommendations.

C. Air Entrainment Admixture: ASTM C 260; contain no chlorides.

   1. Manufacturers:
      a. BASF.
      b. Grace.
      c. Euclid Chemical Co.
      d. GRT.

E. Superplasticizers:
   1. ASTM C494.
   2. Hold slump of 5 inches or greater for time required for placement into structure with maximum water-cement ratio specified.
   3. Furnish type as recommended by manufacturer for allowed temperature ranges.
   4. Type F.
   5. Manufacturers:
      a. BASF.
      b. Grace.
      c. Euclid Chemical Co.
      d. GRT.

2.05 ACCESSORY MATERIALS

A. Reglets: Formed stainless steel sheet, grade 304 or better, with temporary filler to prevent concrete intrusion during placement.

B. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.
   1. Furnish as recommended by manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
      a. Manufacturers:
         1) BASF.
         2) W.R. Meadows.
         3) L&M Construction Chemicals.
         4) Sika Chemical Corp.
         5) Euclid Chemical Co.

C. Patching Material:
   1. Contains no chlorides or other chemicals causing steel corrosion.
   2. Pre-manufactured product, cement-based, suitable for vertical and overhead applications.
   3. Compressive strength at 28 days: 6500 psi minimum
   4. Manufacturers:
      a. BASF.
      b. L&M Construction Chemicals.
      c. Sika Chemical Corp.
      d. Euclid Chemical Co.

D. Chemical Hardener: Magnesium Fluorosilicate solution designed for densification of cured concrete slabs. Hardener shall be compatible with other specified floor treatments and curing compounds. Apply to all slabs unless noted otherwise.

E. Non-Shrink Grout:
   1. ASTM C 1107.
   2. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   3. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
4. Manufacturers:
   b. Euclid Chemical Co., Hi Flow Grout.

2.06 BONDING PRODUCTS

A. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.
   1. Furnish as recommended by manufacturer for surface finish, pot life, set time, vertical or
      horizontal application, and forming restrictions.
   2. Use for all indicated "bonding agent" applications unless specifically directed otherwise on
      Drawings or by Engineer.
   3. Manufacturers:
      a. BASF.
      b. W.R. Meadows
      c. L&M Construction Chemicals.
      d. Sika Chemical Corp.
      e. Euclid Chemical Co.

B. Epoxy Bonding System: ASTM C 881, type as required by project conditions.

2.07 CURING MATERIALS

A. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
   3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

B. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

C. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGNS

A. Design:
   1. Select and proportion ingredients using trial batches or field test data. Sample, cure, and
      test concrete mix through an approved independent testing laboratory in accordance with
      ACI 211.1
   2. ACI 301, 318, and 350 each contain a flow chart for selecting proportions of concrete
      mixtures, and submitting the proposed mixes for approval. Contractor, concrete mix
      supplier and Mix Designer must all be familiar with basic requirements of flow chart and
      include the following basic elements in the design and submittal of all concrete mixes:
      a. Determine whether sufficient test data exists to calculate appropriate standard
         deviations(s) for each ready mix plant that will supply concrete for the Work.
      b. Calculate required average strength, F'cr, for each concrete mix. F'cr: Equal to F'c
         plus 1,200 when data is not available to establish standard deviation.
      c. Show that proposed mixes meet or exceed F'cr by:
         1) Determining whether sufficient test data exists to prove adequacy of proposed mix
            by virtue of similarity to previously-produced concrete, or
         2) Preparing and testing trial batches.
   3. Concrete Compressive Strength, F'c:
      a. See schedule on Drawings
         1) Use additional cement or cement plus fly ash above minimum specified if required
            to meet average compressive strength, F'cr.
         2) For concrete mixes developed by laboratory testing, base cementitious content of
            the concrete on a curve showing the relation between water cementitious ratio
            and 7 and 28 day compressive strengths of concrete made using the proposed
            materials. Determine curves by four or more points, each representing an
            average value of at least three test specimens at each age. Provide curves with a
            range of values sufficient to yield the desired data, including the compressive
            strengths specified, without extrapolation. The cementitious content of the
            concrete mixes to be used, as determined from the curve, shall correspond to
            strengths 1200 psi greater than the specified design strengths. The resulting mix

CAST-IN-PLACE CONCRETE
shall not conflict with the limiting values for maximum water-cementitious ratio and net minimum cementitious content specified.

4. Proportions
   a. Design mix to meet aesthetic and structural concrete requirements.
   b. In accordance with ACI 211.1, unless specified otherwise.
   c. Water-cementitious (W/C) ratio shall control amount of total water added to concrete per schedule on Drawings

5. Admixtures:
   a. Air Content: Per schedule on Drawings.
   b. Fly Ash: Per schedule on Drawings.

6. Slump Range at Site (Maintain Until Consolidated in Form):
   a. After adding superplasticizers: 5 to 8 inches.
   b. Before adding superplasticizers: 1 to 3 inches.

2.09 MIXING

A. General: In accordance with ACI 304R.

B. Truck Mixers:
   1. Equip with electrically actuated counters to readily verify number of revolutions of drum or blades.
   2. Counter:
      a. Resettable, recording type, mounted in driver’s cab.
      b. Actuated at time of starting mixers at mixing speeds.
   3. Truck mixer operation shall furnish a concrete batch as discharged, that is homogeneous with respect to consistency, mix, and grading.
   4. Do not use nonagitating or combination truck and trailer equipment for transporting ready-mixed concrete.
   5. Concrete Volume in Truck:
      a. Limit to 63 percent of total volume capacity, in accordance with ASTM C94, when truck mixed.
      b. Limit to 80 percent of total volume capacity when central mixed.
   6. Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer.
   7. Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
   8. Place materials, including mixing water, in mixer drum before actuating the revolution counter for determining number of mixing revolutions.

C. Aggregates: Thoroughly and uniformly wash before use.

D. Admixtures:
   1. Air-Entraining Admixture: Add at plant through manufacturer-approved dispensing equipment.
   2. Water Reducers: Add prior to addition of superplasticizer.
   3. Superplasticizers and Air-Entraining Admixtures:
      a. Add at concrete plant or at project site only through equipment furnished or approved by admixture manufacturer.
      b. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
      c. Add discharge amount to each load of concrete into separate dispensing container, verify amount is correct, then add to concrete.
      d. Additional dosage of superplasticizer may be added in the field using manufacturer-approved dispensing when unexpected delays cause too great of a slump loss.

E. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify lines, levels, and dimensions before proceeding with work of this section.
B. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

3.02 PREPARATION
A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
B. Form all concrete unless permitted otherwise by Engineer.
C. Verify that forms are clean and free of rust before applying release agent.
D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance with bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
F. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and bond with epoxy adhesive.
   1. Epoxy adhesive for bonding dowels in drilled holes shall be in strict accordance with manufacturer's recommendations.
   2. Adhesive shall be capable of withstanding loads up to 125% of the bar dowel yield strength.
   3. The Contractor shall arrange a meeting with the supplier's technical representative and the Engineer to review the manufacturer's recommendations prior to construction.
   4. Drilled holes for dowels shall be 1/8 inch larger in diameter than the diameter of the bar.
   5. Where not shown on the plans, the minimum embedment depth is 12 times the bar diameter.
   6. Installation procedure:
      a. Blow hole clean using oil-free compressed air.
      b. Place epoxy to predetermined depth in hole, and insert clean bar, working back and forth, up and down to ensure complete embedment and coating.
      c. Position bar in center of hole with template until epoxy sets.
G. Coat forms with release agent before placing reinforcing.
H. Ensure formwork joint offsets conform to ACI 117. Class of surfaces shall be as follows:
   1. Class of surface shall be Class C, unless otherwise noted in the Contract Documents.
   2. Concrete surfaces exposed to view shall be Class A.
   3. Concrete surfaces exposed to flowing water shall be Class A.
   4. Coordinate formwork joint offsets with specified room finishes. Where more stringent class of surface is required by finish manufacturer specifications, adjust Class accordingly.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS
A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.
B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
D. Verify requirements for concrete cover over reinforcement per ACI 318.

3.04 PLACING CONCRETE
A. Preparation: Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.
B. Notify Engineer not less than 24 hours prior to commencement of placement operations.

C. Hand batch ticket for each load of concrete to ENGINEER or delegated representative at time of truck arrival on site.

D. No additional water may be added to the concrete at any time after the truck has left the batch plant.

E. Discharge Time:
   1. As determined by set time, do not exceed 1 1/2 hours after adding cement to water unless special approved time delay admixtures are used. Coordinate information with admixture manufacturer and Engineer prior to placing concrete.
   2. Adjust slump or air content at site by adding admixtures for particular load when approved by Engineer, then adjust plant dose rest of placement. Additional dosage at site shall be through an approved dispenser supplied by admixture manufacturer.
   3. Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of superplasticizer if it fails to maintain slump in required range for the length of time required. Redesign mix, adjusting set control admixtures to maintain setting time in the range required.

F. Placement into Formwork:
   1. Before depositing concrete, remove debris from space to be occupied by concrete.
   2. Prior to placement of concrete, dampen fill under slabs on ground, dampen sand where vapor retarder is specified, and dampen wood forms.
   4. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
   5. Use placement devices, for example, chutes, pouring spouts, and pumps.
   6. Vertical Free Fall Drop to Final Placement: Maximum 4 feet in forms.
   7. Do not use aluminum conveying devices.
   8. Provide sufficient illumination for interior of forms so concrete at places of deposit are visible permitting confirmation of consolidation quality.

G. Retempering: Not permitted for concrete where cement has partially hydrated.

H. Consolidation and Visual Observation:
   1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude required to consolidate concrete in section being placed.
   2. Provide at least one standby vibrator in operable condition at placement site prior to placing concrete.

I. Hot Weather:
   1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
   2. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
   3. Maintain concrete temperature below 80 degrees F at time of placement. Ingredients may be cooled before mixing.
   4. Temperature of forms and reinforcement shall not exceed 90 degrees when concrete is placed.
   5. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.

J. Cold Weather:
   1. Maintain surface temperature of concrete above 40 degrees F and cure concrete as specified in Section 03 3900.
   2. Provide maximum and minimum thermometers placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of
3. Contractor to furnish temperature records daily to Engineer. Keep for each pour for seven days. Record temperature at two hour intervals for:
   a. Outside air.
   b. Concrete as placed.
   c. Air in coldest part of enclosure near concrete.
   d. Locations as directed by Engineer.
4. In accordance with ACI 306R and ACI 318.
5. Heated Enclosures:
   a. Heated enclosures may be used at any time during "cold weather" as defined by ACI 306.
   b. Heated enclosures must be used when outdoor temperature falls below 5 degrees F.
   c. Enclosures must be capable of supporting wind and snow loads and tight enough to prevent entrance of wind and weather.
6. External Heating Units:
   a. Vent heating units to atmosphere, and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.
   b. Do not exhaust flue gases directly into an enclosed area to prevent concentrated carbon dioxide from causing concrete carbonation.
   c. Provide continuous supervision of heating units when in use.
7. Maintain curing conditions as specified in Section 03 3900.
8. Remove protection so concrete temperature drop does not exceed 2 degrees in any one hour and 40 degrees in the first 24 hours after protection removal.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES
A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
B. Correct the slab surface if tolerances are less than specified.
C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE BONDING
A. To Old Concrete:
   1. Mechanically roughen existing concrete surfaces to a clean, rough surface and provide a minimum roughness profile of ¼ -inch.
   2. Saturate surface with water for 24 hours, cover with 2 inches of grout, and place grout as specified for new concrete.

3.07 SURFACE PREPARATION
A. Construction Joints: Prior to placement of abutting concrete, clean contact surface:
   1. Remove laitance and spillage from reinforcing steel, waterstops and dowels.
   2. Roughen surface to a minimum of 1/4 inch amplitude:
      a. Sandblast after the concrete has fully cured.
      b. Water blast after the concrete has partially cured.
      c. Green cut fresh concrete with high pressure water and hand tools.
   3. Perform cleaning so as not to damage water stop, if one is present.

3.08 PATCHING
A. General:
   1. Prior to starting patching work, obtain quantities of color-matched patching material and manufacturer's detailed instructions.
   2. Develop patching techniques with manufacturer on mockup panel.
   3. Dress surface of patches that will remain exposed to view to match color and texture of adjacent surfaces.
B. Tie Holes:
1. Fill with nonshrink grout, except where sealant is shown. Use only enough water to dry pack.
2. Match color of adjacent concrete.
3. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

C. Defective Areas:
1. Remove defective concrete to a depth of sound concrete.
2. If chipping is required, make edges perpendicular to surface with a minimum of 1/2-inch in depth. Do not feather edges. Obtain Engineer's approval of chipping work.
3. Patch defective area to match appearance of adjacent concrete surfaces.

D. Blockouts at Pipes or Other Penetrations:
1. Meet details shown or submit proposed blockouts for review.
2. Use nonshrink grout.

3.09 CONCRETE FINISHING
A. Notify Engineer of any Defective Concrete.
B. Repair surface imperfections, including tie holes, immediately after removing formwork.
1. Chip out honeycomb to sound concrete.
2. Remove all bulges, fins, and small projections by chipping or tooling.
3. Remove all undesired bolts, nails, ties, or other embedded metal to a depth of 1/2 inch from the concrete surface.
4. Remove scale, dirt or other coatings which may impair bond; comply with ACI 318.
5. Fill holes with patching mortar finished to match the surrounding concrete.
6. Adjust cement color as required so that the patches match the adjacent concrete.

C. Verify formwork joint offsets conform to ACI 117, as previously defined under Preparation.
D. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
E. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

3.10 CURING AND PROTECTION
A. Immediately after finishing or stripping forms, apply continuous cover of polyethylene film.
1. Minimum Lap: Six inches (6”).
2. Keep film in place for seven (7) days.
B. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
D. The following requirements shall be maintained until concrete has reached a minimum of 70 percent of its required compressive strength, or for 7 days, whichever is longer:
1. Do not allow temperatures of the concrete to fall below 50 degrees F, nor rise above 90 degrees F.
2. Do not allow the temperature of the concrete surface to change more than 20 degrees F.
3. Maintain wet curing requirements.
E. The above requirements shall be maintained if forms remain in place, or have been removed in accordance with the Contract Documents.
F. Formed Surfaces: Cure by moist curing with forms in place for full curing period or with forms removed with moisture retaining cover or curing compound.
1. Curing compound must be compatible with specified finish schedule. Forms shall be stripped in accordance with current ACI code.
2. Cure surfaces in accordance with ACI 308R.
3. Spraying: Spray water over surfaces and maintain wet for 7 days.

G. Surfaces Not in Contact with Forms:
1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding.
   a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 7 days.
   b. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
2. Final Curing: Begin after initial curing but before surface is dry.
   a. Moisture-Retaining Sheet: Lap strips not less than six inch and seal with waterproof tape or adhesive; secure at edges, maintain in place for not less than 4 days.
   b. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap - side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.
   c. Curing by ponding, spraying or saturated sheet shall be used for all liquid-retaining structures (clarifiers, splitters, basins, etc.) and for all other structures where possible. Membrane curing compound may be used for other structures if specifically requested by Contractor and approved by Engineer.

3.11 FIELD QUALITY CONTROL
A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
B. Provide free access to concrete operations at project site and cooperate with appointed firm.
C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
   1. For each test, mold and cure four concrete test cylinders if 6" cylinders are used. Mold and cure five concrete test cylinders if 4" cylinders are used. Obtain test samples for every 30 cu yd or less of each class of concrete placed. Not less than one test per day.
   2. From each set of cylinders, an approved testing laboratory shall test one cylinder at 7 days and two 6" cylinders (three 4" cylinders) at 28 days. The final cylinder shall be properly stored until after the has reviewed the 7 and 28 day tests. Unless otherwise specified, the 7 day test shall be for informational purposes only. Concrete acceptance shall be based on the average of the two or three cylinders tested at 28 days.
   3. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   4. Passing test shall be as defined in ACI 318.
E. Slump Tests: ASTM C 143.
   1. A minimum of one slump test shall be taken for the first batch of concrete each day and for each set of test cylinders taken. Additional slump tests shall be taken whenever the consistency of concrete appears to vary.
   1. A minimum of one air-content test shall be taken for each set of test cylinders taken. Additional air-content tests shall be taken whenever the proportions of the concrete mix change.
G. Concrete Temperature: ASTM C 1064.
   1. A record of concrete temperature shall be kept for each sample of concrete taken.
H. Method and application of curing shall account for concrete temperature, air temperature, relative humidity, and wind velocity. When evaporation rates exceed 0.2 lb/sq.ft/hour, precautions shall be taken to prevent plastic shrinking cracking. Use Figure 2 1.5 of ACI 305R for evaluating.
3.12 PROTECTION OF INSTALLED WORK
A. After curing and applying final floor finish, cover slabs with plywood or particle board, plastic sheeting, or other material to keep floor clean and protect it from material and damage due to other construction work.
B. Patch and repair defective areas and areas damaged by construction.

3.13 DEFECTIVE CONCRETE
A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.
B. Defective Concrete: Concrete with excessive honeycombing, embedded debris or concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.14 PROTECTION
A. Do not permit traffic over unprotected concrete floor surface until fully cured.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
C. Patch imperfections as directed.

END OF SECTION 03 3000
SECTION 05 0523
ANCHOR BOLTS AND EXPANSION ANCHORS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Post-Installed Anchors.

1.02  REFERENCES

1.03  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data:
   1. Expansion anchors and adhesive anchors:
      a. Current ICC evaluation report or equivalent code agency report listing findings to include installation instructions, acceptance, special inspection requirements and restrictions.
      b. Manufacturer's published installation instructions.
      c. Test data for each size of anchor to be used: Verification that anchor is capable of developing allowable loads shown on Drawings.

PART 2  PRODUCTS

2.01  MATERIALS
A. Anchor Bolts and Nuts (including threaded rod anchors): All bolts and nuts are to be stainless steel unless specifically indicated otherwise on Drawings.
   1. Stainless Steel:
      a. Bolts: ASTM F593, Grade 316.
B. Threaded Rod Anchors and Nuts
   1. Stainless Steel:
      a. Bolts: ASTM F593, Alloy Group 1 or 2.
      b. Nuts: ASTM F594, Alloy Group 1 or 2.
C. Adhesive Anchors (for concrete and grout filled masonry): See Structural Drawings.
   1. System as indicated on Structural Drawings.
   2. Threaded Rod Anchors and Nuts
      a. As specified for threaded rod anchors.
   3. Adhesive
      a. Two-component liquid, moisture-insensitive epoxy adhesive with viscosity appropriate for the location and application. Components shall be packaged at the factory in a dual-chambered cartridge.
D. Flat Washers: ANSI B18.22.1; of the same material as anchor bolts and nuts.

2.02  ANCHORS
A. General:
   1. Anchor bolts, threaded rod anchors, and adhesive anchors which are to be epoxy grouted shall be clean and free of coatings that would weaken the bond with the epoxy.
   2. Two nuts, a jam nut, and a washer shall be furnished for anchor bolts, threaded rod anchors, and adhesive anchors indicated on the drawings to have locknuts; two nuts and a washer shall be furnished for all other anchor bolts, threaded anchor rods, and adhesive anchors.
3. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchor bolts, threaded rod anchors, and adhesive anchors immediately before final installation and tightening of the nuts.

B. Threaded Rod Anchors:
1. Adhesive for threaded rod anchors shall be as specified herein.
2. The embedment depth for threaded rod anchors shall be at least 15 rod diameters.

C. Adhesive Anchors:
1. An acceptable adhesive system may be used as an alternative in locations where epoxy grouted anchor bolts and threaded rod anchors are specified or indicated.
2. When acceptable to the Engineer, adhesive anchors shall be anchored in holes drilled into hardened concrete or grout filled masonry.

D. Expansion Anchors:
1. When expansion anchors are indicated on the drawings, only an acceptable expansion anchor shall be used. Alternative anchoring systems may be used only when acceptable to the Engineer.
2. Expansion anchors shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of the hole be less than six bolt diameters.
3. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least six times the diameter of the bolt. Unless otherwise indicated on the drawing, the minimum distance between the centers of expansion anchors shall be at least 12 times the diameter of the bolt.
4. Anti-seize thread lubricant shall be liberally applied to threaded stainless steel components of expansion anchors immediately before installation.

2.03 EPOXY GROUT
A. General:
1. Two-component liquid epoxy adhesive of viscosity appropriate for the location and application, and an inert aggregate filler component, if recommended by the adhesive manufacturer.
2. Components shall be packaged at the factory and shall be mixed immediately before use. Proportioning and mixing of the components shall be done in accordance with the manufacturer's recommendations.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION
A. Adhesive Anchors and Expansion Anchors: Install in strict compliance with Manufacturer's instructions and with limitations of ICC Reports.
1. Anchors attaching beams or channels on top of and supporting existing floor slabs shall be mechanical expansion anchors, including mixer support frame anchors and Mechanical Room W12 Beam anchors. Installation of grout to fill gaps between steel members and the floor slabs and subsequent anchor installation are to be carried out and in place prior to demolition and coring or cutting holes in the floor slabs.

3.03 FIELD QUALITY CONTROL
A. Notify Engineer when adhesive anchors are ready for each of two separate inspections. Allow 24 hours for Engineer's inspection. Any adhesive anchor completed without inspection is subject to rejection by Engineer, and subject to replacement by an additional adhesive anchor at no additional expense to Owner.

END OF SECTION 05 0523
SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Structural steel framing and support members.
B. Grouting under steel base plates and between slabs and support members.

1.02 REFERENCE STANDARDS
A. Use most up to date ASTM standards and use codes as required by authorizing agency having jurisdiction.
B. AWS 1.6 - Structural Welding Code - Stainless Steel
D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar, 2015.
I. AISC (MAN) - Steel Construction Manual.
M. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
Q. AWS D1.1/D1.1M - Structural Welding Code - Steel.
R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
S. SSPC-SP 1 - Solvent Cleaning.
T. SSPC-SP 3 - Power Tool Cleaning.
U. SSPC-SP 5 - White Metal Blast Cleaning.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Indicate type and location of all shop and field Connections.
   3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Including type, size and length of all welds.
5. No variation from design sizes will be permitted but recommendations for modifications of details to better suit the fabricator's shop practice will be considered, if specifically brought to the attention of the Engineer.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience. Submit documentation of experience upon request.

C. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience. Submit documentation of experience upon request.

D. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in State where project is located.

E. Verify all existing dimensions, materials, and conditions are as shown on the drawings prior to any fabrication.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hot-Rolled Structural Steel W, WT, M, MT, S, and ST shapes:
1. Stainless Steel W Shapes, C-Shapes, and Angles: ASTM A276
2. Grade 304/304L

B. Cold-Formed Structural Tubing (HSS Sections): ASTM A500/A500M, Grade B.

C. Stainless Steel Plate: ASTM A276.
1. Grade 304/304L

D. High-Strength Structural Bolts: ASTM F593, Grade 316.

E. Welding Materials: E70XX electrodes, type required by AWS D1.1/D1.1M and AWS D1.6/D.1.6M for materials being welded.

F. Grout: Non-shrink, see Section 03 3000 - Cast-in-Place Concrete.
1. Grout shall remain workable for a minimum of 30 minutes following mixing.

G. Touch-Up Compound for Galvanized Surfaces: Zinc rich type containing 95 percent metallic zinc in the dried film. Use ZRC Galvilite cold galvanizing compound or approved equivalent.

2.02 FABRICATION

A. General
1. Fabricate in accordance with reviewed shop drawings and reference standards.
2. Shop fabricate to greatest extent possible. Field work shall consist only of erection.
3. Continuously seal joined members with continuous welds. Grind exposed welds smooth.
4. All steel shall be accurately fitted and provided with identification mark before it is delivered to building site.
5. High strength bolted connections shall be designed as bearing connections, unless specifically noted on the drawings as slip-critical (SC). Hole types shall be standard or short slotted holes normal to the load direction.
6. Blade cut, drill or punch holes perpendicular to metal surfaces. Flame cutting of holes or enlargement of holes by burning is not permitted.
7. Shearing and punching shall leave true, clean lines and surfaces.
8. Exercise special caution in fabrication of exposed steel shapes; grind smooth all raised lettering and blemishes on exposed steel; grind smooth all coped areas.
9. For stud anchors, use only automatically timed stud welding equipment and follow all manufacturer's recommendations. Hand shield metal arc welding of studs will not be permitted.

B. Shop Cleaning
1. Slag on welds, and excess weld splatter shall be removed by chipping or grinding.
2. Loose mill scale and rust shall be removed in accordance with the paint manufacturer's specifications.
3. Oil and residues which would prevent adherence of paint to steel shall be removed with solvent.

C. Fabrication Welding
1. Fabrication welding and welding equipment shall comply with referenced standards.
2. Surfaces shall be free of scale, rust, grease, paint and other foreign materials prior to welding.
3. Welds shall show uniform section, smoothness of weld material, freedom from porosity and clinkers, and of adequate strength and durability.
4. Welds not otherwise identified shall be continuous.
5. No welding shall be attempted when base metal temperature is lower than 0 degrees F.
6. Slag on welds, and excess weld splatter shall be removed by chipping or grinding.

2.03 FINISH
A. Prepare structural component surfaces in accordance with SSPC SP 2. Remove oil, grease, and similar contaminants, complying with SSPC-SP 1 Solvent Cleaning.

B. Leave Stainless Structural Steel members un-primed. Passivate all stainless steel shapes and parts.

C. Structural steel members to be galvanized shall comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

B. Beginning of installation means erector accepts existing conditions.

3.02 ERECTION
A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. No field welding allowed without approval by Engineer.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) “Specification for Structural Joints Using High-Strength Bolts”.

E. Do not field cut or alter structural members without approval of Engineer.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Furnish all anchors, bearing plates and setting templates to the appropriate trades as required for their placement in adjacent concrete or masonry work.

H. Set column base plates level and at correct elevations. Temporarily support base plates on leveling nuts, steel wedges or shims until supported members are plumbed and grouted as required.

I. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.
J. For the installation of epoxy grouts, follow the recommendations of the manufacturer for proper surface preparation, grout placement, pot life, and curing times.

K. Light drifting necessary to draw holes together will be permitted; drifting to match misaligned holes is not allowed. When misaligned holes are encountered, contact the Engineer for correction requirements. Field burning of holes is not allowed.

L. Unless notes as slip-critical (SC) or specifically indicated otherwise on the drawings, all field connections shall be bolted using 3/4 inch high strength bolts installed to the snug tight condition. The snug tight condition is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Additionally, the high strength bolted connections shall be additionally tightened such that contact surfaces between members being connected is tight.

M. Where noted on the drawings as slip-critical (SC), provide slip-critical field bolted connections using 3/4 inch diameter high strength bolts fully tensioned to 70 percent of the minimum tensile strength. Provide a load indicator washer at each bolt. Direct tension indicator tightening shall be the only acceptable tightening method. Bolts shall be installed in connection holes brought to a snug fit. After initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of the connection to the free edges. Follow the manufacturer's instructions for the installation of the load indicator washers.

N. High strength bolts used in conjunction with welded joints at moment connections must be tightened to specification requirements prior to welding or joints.

O. Connections not noted for welding shall be bolted.

P. Bolt holes shall be drilled or punched, not burned.

Q. A sequence of welding of moment joints shall be established to minimize distortion and stress of structure due to weld metal shrinkage.

R. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete, galvanized surfaces, or surfaces which are to be spray fireproofed.

S. After erection, touch up all welds and abrasions of galvanized finishes with a minimum of two coats of cold galvanizing compound applied in accordance with the manufacturer's printed instructions.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. General

B. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

C. Bolting

1. High-Strength Bolts: Provide testing and verification of field-bolted bearing type connections in accordance with AISC "Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts", testing at least 10 percent of bolts at each connection.

2. All slip-critical (SC) bolted connections shall be checked for proper installation and tensioning requirements.

3. Anchors supporting concrete floor slabs shall be installed snug tight plus 1/4 turn. Carry out second pass tightening any loose (not at least snug tight) bolts using the same criteria.

4. Loose bolts in a connection or bolts encountered which do not meet specification requirements by testing, will be cause for rejection of the connection.

5. Bolts will be reinspected for proper grip length as indicated on the reviewed shop drawings; improper grip length shall be cause for rejection.

6. Re-use of high strength bolts which have been tightened previously, or use of bolts which have suffered thread damage, is not permitted.
7. Correction of hole misalignment by burning or cutting with a torch is not permitted.
   Correction of misalignment of bolt holes shall be by reaming.
8. Oversizing of the bolt holes or elongation of the bolt holes by reaming, beyond the tolerance
    allowed by the specification requirements, shall be required using the next larger diameter
    high strength bolt in the hole.
9. Tightening of the high strength bolted connections shall be such that contact surfaces are
    tight.

D. Welding
1. All field welds shall be subjected to a thorough visual inspection by the welder, for the
   purpose of determining compliance with the contract documents.
2. Welds found to be defective due to improper size, length, or profile, or to contain defects
   prohibited by the reference code, are to be repaired by the fabricator to meet contract
   requirements.
3. Repairs made to the defective welds shall be reinspected by the original method used.
   Reinspection costs shall be paid by the Contractor.
   a. 25% of the designated full penetration welds shall be selected at random and
      subjected to radiograph testing by testing laboratory.
   b. The technique for radiograph testing and interpretation of the results of the testing shall
      be in accordance with the applicable sections of the American Welding Society
      Structural Welding Code.
   c. Defect levels above those allowed by the referenced code will be cause for additional
      radiograph testing of the full penetration welds.
   d. Welds which are found to contain defects greater than the tolerances allowed by the
      referenced code shall be repaired at the Contractor’s expense.

END OF SECTION 05 1200
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Structural composite shapes and plates.

1.02 DEFINITIONS
A. Fiber-Reinforced Polymer (FRP): A fiber-reinforced polymer material that consists of a polymer resin-based matrix with fibers of either glass, carbon or aramid, and hybrid combinations of these fiber types.

1.03 REFERENCE STANDARDS
B. ACMA (FRP) - Guidelines and Recommended Practices for Fiber-Reinforced-Polymer (FRP) Architectural Products.
D. ASCE/ACMA (PS) - ASCE/ACMA Pre-Standard for Load & Resistance Design (LRFD) of Pultruded (FRP) Structures.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.
B. Product Data: Manufacturer's published product literature.
C. Shop Drawings: For each system; indicate:
   1. Plans and Sections: Include elevations and dimensions; indicating locations of members, connections, and other information.
   2. Details: Include cuts, copes, notches, holes, openings, and erection lifting points.
D. Samples: Submit two samples, 12 inches by 12 inches in size, indicating specified color.
E. Test Reports:
   1. Material property test results for flange and web of relevant cross-section profiles for both flange and web relevant cross-section profiles; provide test results in compliance with ASTM D7290 for the following properties:
   2. Test results of structural shapes of full section flexural modulus for relevant beam and angle cross-section profiles; provide test results in compliance with ASTM D8069.
F. Manufacturer's Instructions: Manufacturer's published erection instructions.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications:
1. Documented Experience: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
2. AMCA Member: Member of American Composites Manufacturer's Association (AMCA).

B. Fabricator Qualifications:
1. Fabricator Qualifications: Company specializing in fabricating products specified in this section, with at least five years of documented experience.
2. ACMA Member: Member of American Composites Manufacturer's Association (AMCA).

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to project site in original, unbroken packages, or bundles bearing the label of the manufacturer and component identification markings.
B. Store materials under cover and elevated above grade.
C. Protect structural composites from damage including cracking or chipping.
D. Handle and store FRP components in compliance with handling and storage requirements of ACMA (FRP).

PART 2 PRODUCTS
2.01 STRUCTURAL COMPOSITE SHAPES AND PLATES
A. Glass-Fiber-Reinforced Polymer (FRP) Structural Composites:
   1. Surface Burning Characteristics: Flame spread rating of 25 or less when tested in accordance with ASTM E84.
   2. Structural shapes manufactured by the pultrusion process.
   3. Provide FRP shapes and plates as indicated on drawings and in compliance with ASCE/ACMA (PS).
   4. Polymeric Resin: As required to meet design criteria, compatible with reinforcement fibers to develop mechanical and structural properties.
   5. Resin System Additives: Compatible with fiber and resin systems.
      a. Surface coatings with ultraviolet (UV) inhibitors.
B. Finishes:
C. Fabrication:
   1. Shop fabricate systems and sub-systems to largest practical size suitable for transporting.
   2. Fabricate structural composite systems in accordance with ANSI/ACMA/PIC (CSP).
   4. Seal holes and other openings with a compatible resin coating.
   5. Cure and clean component prior to shipment; remove material incompatible with adjacent building materials.

2.02 DESIGN CRITERIA
A. Design Loads:
   1. Roof Live Load: 20 psf; deflection limited to 1/240 of span.
   2. Wind Loads:
      a. Wind Loads: 8 psf; deflection limited to 1/240 of span.

2.03 ACCESSORIES
A. Stainless Steel Fasteners
   3. Washers: Provide washers of materials compatible with stainless steel grades of bolts and nuts; in compliance with size requirements of ASTM A436.
B. Adhesives: Structural grade adhesives as recommended by the manufacturer.
PART 3  EXECUTION

3.01  EXAMINATION
   A. Verify dimensions, tolerances, and interfaces with other work.
   B. Examine field conditions to confirm that building lines, grades, and elevations will allow proper
      erection of structural composites.
   C. Verify support work has been constructed to allow accurate placement and alignment of plates.
   D. Verify substrates to determine that conditions are acceptable for erection of structural composites
      in accordance with manufacturer's written instructions.

3.02  ERECTION
   A. Erect structural composites in accordance with ANSI/ACMA/PIC (CSP), manufacturer's erection
      instructions, and approved shop drawings.
   B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe
      condition, and in true alignment until completion of erection and installation of permanent
      bracing.
   C. Do not field cut or alter structural members without written approval of the Structural Engineer of
      Record for design of the FRP structural composite systems.

3.03  TOLERANCES
   A. In compliance with erection tolerances indicated in ANSI/ACMA/PIC (CSP).

3.04  CLEANING
   A. Clean FRP components in compliance with cleaning recommendations in ANSI/ACMA/PIC
      (CSP).

3.05  PROTECTION
   A. Protect installed structural composites from subsequent construction operations.

END OF SECTION  06 7100
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SECTION 08 1116
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Flush aluminum doors with aluminum face sheets.
B. Flush door panels.
C. Accessories, including fasteners and brackets.

1.02 REFERENCE STANDARDS
C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.
C. Shop Drawings: Include elevations of each opening type.
D. Selection Samples: Complete set of color and finish options, using actual materials, for Engineer's selection.
E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver aluminum components in manufacturer's standard protective packaging, palleted, crated, or banded together.
B. Inspect delivered components for damage and replace. Repaired components will not be accepted.
C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
D. Protect materials and finish from damage during handling and installation.

1.06 FIELD CONDITIONS
A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate on shop drawings. Coordinate fabrication with project schedule to avoid delays in the work.
B. Do not begin installation of interior aluminum components until space has been enclosed and ambient thermal conditions are being maintained at levels consistent with final project requirements.
C. Schedule to ensure that templates required for reinforcement for door hardware specified in Section 08 7100, and/or actual hardware requested by Manufacturer, are available in time for fabrication without affecting construction progress schedule.

1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Flush Aluminum Doors with Aluminum Face Sheets:
   2. Special-Lite, Inc., Decatur Michigan, Tel. (800) 821-6531.
   3. Engineer approved equivalent.

2.02 DOORS AND FRAMES
A. Flush Aluminum Doors with Aluminum Face Sheets: Aluminum internal framing and faces; no steel components.
   2. Facing: Seamless aluminum sheet, 0.040 inch thick, smooth texture, laminated to 1/8 inch tempered hardboard.
   3. Finish: Class I - Natural anodized.
B. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
   1. Provide the following clearances:
      b. Between Meeting Stiles: 1/4 inch.
      c. At Top Rail and Bottom Rail: 1/8 inch.

2.03 COMPONENTS
A. Flush Door Panels: Without visible seams on face sheet.
   1. 1-3/4” thick doors
   2. Framing and Hardware Backup: Extruded aluminum tubing, 1/8 inch minimum thickness.
   4. Core: Rigid insulating material of not less than 2.0 lb/cu ft density.
   5. Laminating Adhesive: Manufacturer's standard low-VOC materials.
B. Additional Door Hardware: See Section 08 7100.

2.04 PERFORMANCE REQUIREMENTS
A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
B. Overall U-value, Including Glazing: Compliant with IECC 2015, 0.35, minimum, measured on exterior door size required for this project.

2.05 MATERIALS
A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy 5005, temper H14, stretcher leveled.
B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.

2.06 FINISHES
A. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mils, 0.0007 inch.
B. Color: As indicated on drawings. If not indicated, then Engineer will select color from available standards.
C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 FINISHES
A. Finish: Clear anodic coating; AA-M12C22A42 Class I mechanical finish, nonspecular as fabricated, with medium-matte etch, minimum thickness 0.7 mil.

2.08 FABRICATION
A. Aluminum Doors and Panels: Type, size and design as indicated.
2. Door sizes shown are nominal; provide standard clearances as follows:
   a. Hinge and Lock Stiles: 0.125 inch.
   b. At Top Rail and Bottom Rail: 0.125 inch.

2.09 ACCESSORIES
A. To ensure correct operation of door and hardware, all vision panels and door hardware shall be factory fitted and applied at no additional cost beyond the cost of hardware preparation. Refer to Section 08 7100 for Door Hardware.
B. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
C. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.
D. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil thickness per coat.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.
B. Verify that frames installed by other trades for installation of doors of this section are in strict accordance with recommendations and approved shop drawings and within tolerances specified in manufacturer's instructions.

3.02 PREPARATION
A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
B. Replace components with damage to exposed finishes.
C. Separate dissimilar metals to prevent electrolytic action between metals.

3.03 INSTALLATION
A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.
B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
   1. Seal metal-to-metal joints between framing members using good quality elastomeric sealant.
C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint, applying elastomeric sealant between the different metals, or using nonabsorptive tape or gasket in permanently dry locations.
D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

3.04 CLEANING
A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.
B. Do not use abrasive, caustic, or acid cleaning agents.
3.05 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION 08 1116
SECTION 08 7100
DOOR HARDWARE

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Hardware for aluminum doors.
B. Hardware for fire-rated doors.
C. Thresholds.

1.02  RELATED REQUIREMENTS
A. Section 08 1116 - Aluminum Doors and Frames.

1.03  REFERENCE STANDARDS
A. BHMA A156.1 - Standard for Butts and Hinges.
B. BHMA A156.2 - Bored and Preassembled Locks and Latches.
C. BHMA A156.3 - Exit Devices.
D. BHMA A156.4 - Door Controls - Closers.
E. BHMA A156.5 - Cylinders and Input Devices for Locks.
F. BHMA A156.6 - Standard for Architectural Door Trim.
G. BHMA A156.7 - Template Hinge Dimensions.
H. BHMA A156.8 - Door Controls - Overhead Stops and Holders.
I. BHMA A156.16 - Auxiliary Hardware.
J. BHMA A156.17 - Self Closing Hinges & Pivots.
K. BHMA A156.18 - Materials and Finishes.
L. BHMA A156.21 - Thresholds.
M. BHMA A156.22 - Standard for Gasketing.
N. BHMA A156.26 - Standard for Continuous Hinges.
O. BHMA A156.30 - High Security Cylinders.
P. ITS (DIR) - Directory of Listed Products.
Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
S. UL (DIR) - Online Certifications Directory.
T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
U. UL 437 - Standard for Key Locks.

1.04  SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Provide complete description for each door listed.
   3. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   4. Include account of abbreviations and symbols used in schedule.
1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
1. Closers: Five years, minimum.
2. Exit Devices: Three years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS
2.01 DESIGN AND PERFORMANCE CRITERIA
A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
B. Provide individual items of single type, of same model, and by same manufacturer.
C. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or [_____] as suitable for application indicated.
D. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
   a. Aluminum fasteners are not permitted.
   b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Fire-Rated Applications: Comply with NFPA 80.
   a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
   b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES
A. Manufacturers:
B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Self Closing Hinges: Comply with BHMA A156.17.
2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   a. Provide hinge width required to clear surrounding trim.
4. Provide hinges on every swinging door.
5. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
6. Provide ball-bearing hinges at each door with closer.
7. Provide following quantity of butt hinges for each door:
   a. Doors up to 60 inches High: Two hinges.
   b. Doors From 60 inches High up to 90 inches High: Three hinges.
   c. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
   d. Dutch Doors: Two hinges each leaf.

2.03 FLOOR CLOSERS
A. Floor Closers: Comply with BHMA A156.4, Grade 1.
B. Type: Standard-duty, with 2 inch shallow depth floor preparation, and having 250 pounds carrying weight.

2.04 FLUSH BOLTS
A. Manufacturers:
   1. Ives, an Allegion brand: www.allegation.com/us/#sle.
B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
   2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
      a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
   3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
   5. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
   6. Automatic Flush Bolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened; located on inactive leaf of pair of doors.

2.05 EXIT DEVICES
A. Manufacturers:
B. Exit Devices: Comply with BHMA A156.3, Grade 1.
   1. Lever design to match lockset trim.
   2. Provide cylinder with cylinder dogging or locking trim.
   3. Provide exit devices properly sized for door width and height.
   4. Provide strike as recommended by manufacturer for application indicated.
   5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.06 LOCK CYLINDERS
A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide standard, electronic, conventional, full size interchangeable core (FSIC), and small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
   2. Provide high security mechanical type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.30 or UL 437 at locations indicated.
   3. Provide cylinders from same manufacturer as locking device.
   4. Provide cams and/or tailpieces as required for locking devices.

2.07 CYLINDRICAL LOCKS
A. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
   1. Bored Hole: 2-1/8 inch diameter.
   2. Latchbolt Throw: 1/2 inch, minimum.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
   a. Finish: To match lock or latch.
   b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
   c. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
   d. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
   e. Rabbet Front and Strike: Provide on locksets for use with rabbeted meeting rails.
5. Provide an office lockset for swinging door where hardware set is not indicated.
6. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.08 DOOR PULLS AND PUSH PLATES
A. Door Pulls and Push Plates: Comply with BHMA A156.6.
   1. Pull Type: Straight, unless otherwise indicated.
   2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
      a. Edges: Beveled, unless otherwise indicated.
   3. Material: Aluminum, unless otherwise indicated.
   4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
   5. On solid doors, provide matching door pull and push plate on opposite faces.
   6. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

2.09 DOOR PULLS AND PUSH BARS
A. Door Pulls and Push Bars: Comply with BHMA A156.6.
   1. Bar Type: Bar set, unless otherwise indicated.
   2. Material: Aluminum, unless otherwise indicated.

2.10 COORDINATORS
A. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
   1. Type: Bar, unless otherwise indicated.
   2. Material: Aluminum, unless otherwise indicated.
   3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.11 CARRY BAR
A. Carry Bar: Provides a push on active door when inactive door is opened first to allow coordinator to be engaged for proper door leaf closing sequence.
   1. Material: Brass with nylon rollers, unless otherwise indicated.

2.12 CLOSERS
A. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: Surface mounted to door.
   2. Provide door closer on each exterior door.
   3. Provide door closer on each fire-rated and smoke-rated door.
   4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
   5. At corridor entry doors, mount closer on room side of door.
   6. At outswinging exterior doors, mount closer on interior side of door.

2.13 OVERHEAD STOPS AND HOLDERS
A. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
   1. Provide stop for every swinging door, unless otherwise indicated.
2. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.

2.14 PROTECTION PLATES
   A. Protection Plates: Comply with BHMA A156.6.
   B. Metal Properties: Aluminum.
      1. Metal, Standard Duty: Thickness 0.05 inch, minimum.
   C. Edges: Beveled, on four sides unless otherwise indicated.
   D. Fasteners: Countersunk screw fasteners.
   E. Provide clear anti-microbial coating that is silver ion-based.

2.15 ARMOR PLATES
   A. Armor Plates: Provide on bottom half of push side of doors that require protection from objects moving through openings that may damage door surface.
      1. Size: 16 inch high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.

2.16 KICK PLATES
   A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
      1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.17 MOP PLATES
   A. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
      1. Size: 6 inch high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.

2.18 DOOR HOLDERS
   A. Door Holders: Comply with BHMA A156.16, Grade 1.
      1. Provide surface mounted door holders when wall or floor stop is not applicable and hold-open device is mounted on door.
      2. Type: Lever, or kick down stop, with rubber bumper at bottom end.

2.19 FLOOR STOPS
   A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
      1. Type: Manual hold-open, with pencil floor stop.

2.20 WALL STOPS
   A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
      1. Provide wall stops to prevent damage to wall surface upon opening door.
      2. Type: Bumper, concave, wall stop.

2.21 ASTRAGALS
   A. Manufacturers:
   B. Astragals: Comply with BHMA A156.22.
      1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
      2. Type: Split, two parts, and with sealing gasket.
      3. Material: Aluminum, with neoprene weatherstripping.
      4. Provide non-corroding fasteners at exterior locations.
2.22 THRESHOLDS
A. Manufacturers:
B. Thresholds: Comply with BHMA A156.21.
   1. Provide threshold at interior doors for transition between two different floor types, and over
      building expansion joints, unless otherwise indicated.
   2. Provide threshold at each exterior door, unless otherwise indicated.
   3. Type: Flat surface.
   5. Threshold Surface: Fluted horizontal grooves across full width.
   6. Field cut threshold to profile of frame and width of door sill for tight fit.
   7. Provide non-corroding fasteners at exterior locations.

2.23 LATCH PROTECTOR
A. Latch Protector: Provide on door to protect latch from being tampered with while in locked
   position.
   1. Type: Standard latch protector.

2.24 SILENCERS
A. Silencers: Provide at equal locations on door frame to mute sound of door’s impact upon closing.
   1. Single Door: Provide three on strike jamb of frame.
   2. Pair of Doors: Provide two on head of frame, one for each door at latch side.

2.25 FINISHES
A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material
      (former US equivalent US26); BHMA A156.18.
   2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base
      material (former US equivalent US26D); BHMA A156.18.
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or
         stainless steel finished appliances, fittings, and equipment; provide primary finish on
         one side of door and secondary finish on other side if necessary.
   3. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an
         equivalent appearance in accordance with BHMA A156.18.
      b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance
         with NFPA 80.
      c. Door Closer Covers and Arms: Color as selected by Engineer from manufacturer’s
         standard colors unless otherwise indicated.
      d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish,
         not other hardware, unless otherwise indicated.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames
   are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION
A. Install hardware in accordance with manufacturer's instructions and applicable codes.
B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA
   80.
C. Use templates provided by hardware item manufacturer.
D. Do not install surface mounted items until application of finishes to substrate are fully completed.
E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL
A. Perform field inspection and testing under provisions of Section 01 4000 - Quality Requirements.

3.04 ADJUSTING
A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.
B. Adjust hardware for smooth operation.
C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING
A. Clean finished hardware in accordance with manufacturer’s written instructions after final adjustments have been made.
B. Clean adjacent surfaces soiled by hardware installation.
C. Replace items that cannot be cleaned to manufacturer’s level of finish quality at no additional cost.

3.06 PROTECTION
A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
B. Do not permit adjacent work to damage hardware or finish.

PART 4 DOOR HARDWARE SCHEDULE
4.01 GENERAL
A. Hardware items are referenced in the following hardware groups. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
B. The hardware sets listed below represent the design intent and direction of the Owner and Architect. They are guidelines only and should not be considered a detailed hardware schedule. It is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability and proper functioning of the hardware specified herein. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with proposed solutions.
C. Manufacturer's Abbreviation List:
   1. (GLY) - Glynn-Johnson
   2. (IVE) - Ives
   3. (LCN) - LCN Closers
   4. (SCH) - Schlage Locks
   5. (SCE) - Schlage Electronics
   6. (VON) - Von Duprin
   7. (ZER) - Zero International

4.02 HARDWARE SET 1:
A. For use on Door #(#s):
   1. New Electric Room Door
B. Provide each SGL door(s) with the following:

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<th>DESCRIPTION</th>
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<th>FINISH</th>
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DOOR HARDWARE 08 7100 - 7
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END OF SECTION 08 7100
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 22 and 23 Sections, in addition to General and Supplementary Conditions and General Requirements.

B. The general provisions of this section apply to the other Division 22 and 23 sections where applicable.

C. The work shall include the furnishings of systems, equipment and materials specified in this Division and as called for on the Mechanical Drawings, to include: supervision, operation, methods and labor for the fabrication, installation, startup and tests for the complete mechanical installation.

D. Drawings for the work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangement and locations of the work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. Where such items are required for proper installation of the Work, such items shall be included.

E. Equipment specification may not deal individually with minute items required such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for.

F. Where noted on the Drawings or where called for in other sections of the specification, the Contractor for this division shall install equipment furnished by others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

G. Contractor to field verify the exact size and service of existing systems before making final connections.

1.02 REFERENCES

A. Imposed Standards/Regulations

1. Applicable provisions of the following codes and standards are hereby imposed on a general basis for the mechanical work (in addition to specific applications specified by individual work sections of these specifications and in addition to applicable local and state codes.
   a. ANSI Pressure Piping Standards (B31-Series).
   e. American Gas Association.
   f. AWS Standards for Welding.
   h. NFPA Standards and Pamphlets.
   i. Local and/or State Plumbing, Mechanical and Building codes.
   j. Uniform Plumbing Code.
   k. International Mechanical Code.
   m. International Fire Code

2. Every installation shall comply with applicable sections of every other specification. Changes required to conform shall be made without increase in contract price, after approval by Engineer in writing. If changes are required to obtain above approvals, Contractor shall submit them to Engineer for approval, after which revised data shall be
submitted and written approval obtained. Changes shall be made without increase in contract price.

3. Installations must be entirely safe in every respect, and must not create any condition of any kind which will be harmful to any occupant of building, to operating personnel, to installation personnel, to testing personnel, to workmen, and to public; Contractor for each installation shall be solely responsible for providing installations which will meet these conditions. If Contractor or Manufacturer believes that installation will not be safe for all parties, they shall so report in writing to the Engineer before any equipment is purchased or work is installed, giving exact recommendations.

4. Manufacturer of each type of equipment used by itself or as a part of any system shall carefully check capacities, arrangements, and methods shown or specified (including space requirements, servicing requirements, ambient air temperatures, etc.) for installation of their equipment, and all connections to other system or to parts of same system to assure that when used, connected, interconnected, piped, wired, or controlled as specified, it can be properly serviced. If the manufacturer has any reservations in this regard, they shall state the reservations and/or suggested changes in a separate letter addressed to the Engineer and shall include this letter as a part of the shop drawing submission.

5. If Contractor fails to call such reservations or suggestions to Engineer's attention, in writing, before any work is done or equipment is purchased, it will be assumed that they accept responsibility for providing a completely safe and completely coordinated installation. If at a later date changes become necessary to assure a completely safe and coordinated installation, they shall be made, as approved by Engineer, without increase in contract price.

B. Permits and Tests

1. The Contractor shall obtain and pay for all fees, permits and licenses required by Work, unless otherwise noted in the detailed contractual description preceding these mechanical specifications.

2. All applications required for the procuring of new utility services to the building (gas, water, sewer, or steam) shall be properly filed by the Contractor with the utility company.

3. Submit a record copy (for Owner's records) of mechanical work notices, permits, licenses, inspection or test reports, and similar items obtained in response to governing and imposed regulations and standards.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 PROJECT/SITE CONDITIONS

A. Inspect site prior to bidding to be thoroughly familiar with existing conditions.

B. Work to be installed as shown on Drawings, unless prevented by actual project conditions.

C. Prepare and submit drawings with bid proposal showing proposed rearrangement of work, if required, to meet actual project conditions, including changes to work specified in other Sections. Approval by Engineer required before proceeding. No extras can be allowed on work required by discrepancies in actual project conditions after contract for work has been awarded.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. All materials and equipment shall be fully guaranteed by the Contractor to be free from defects and to be new equipment; no second-hand, used, or salvaged equipment will be allowed.

C. Replacement of any part which fails within one year from the date of acceptance shall be made by the Contractor without cost to the Owner.

D. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.
PART 2 PRODUCTS

2.01 PRODUCT AND PERFORMANCE QUALITY

A. All materials shall be the standard product of a reputable manufacturer regularly engaged in the manufacture of the specific product, and where more than one unit is required of the item, all shall be of the same manufacturer.

B. The Engineer reserves the right to refuse approval on equipment which does not meet the specification in their opinion, or on equipment for which no local experience of satisfactory service is available. The Engineer further reserves the right to reject equipment for which maintenance service and the availability of replacement parts is questionable.

C. Any materials not conforming to the specification will be ordered removed any time during the course of construction, and the Contractor shall replace such items, when notified, at their own expense.

D. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

E. It will be the Contractor's responsibility to examine fully the drawings and specifications, to take the required measurements, to verify dimensions and to fit Work into the schedule of other Contractors, and to progress the contract as expeditiously as possible, so that the progress of the work is orderly and does not occasion excessive cutting and patching of this new structure.

F. This Contractor shall be pecuniarily responsible for the cutting and patching of the structure occasioned by failure to install sleeves, grilles or other items required by the mechanical work at the proper time for the normal installation of such items.

G. All ductwork shall be measured on the job prior to fabrication. Piping rough-in dimensions and locations shall be verified with the Owner or supplier of equipment furnished by others prior to the time of roughing-in.

2.02 SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for product requirements and substitution procedures.

B. Proposals as submitted shall be based on the products specifically named in the specifications.

C. If specific products of more than one manufacturer are specified, the choice of these shall be made optional with the Contractor.

D. All products are subject to review by the Engineer both before and after incorporation in the project.

E. Should suppliers of materials not specified wish to bid their material as a base bid equal, they shall submit specific product data for each proposed substitution and secure the written approval of the Engineer that their product is acceptable as an equal to that specified at least ten (10) days in advance of the bid date to have their products covered in an Addendum prior to opening of bids. The burden of proof of equivalence is on the proposer.

2.03 RECORD DRAWINGS

A. See Section 01 7800 - Closeout Submittals for additional project record drawing requirements.

B. Contractor shall prepare and submit to Engineer a drawing showing the exact location of all concealed, above ground and underground piping and ductwork. Drawing shall give accurate location dimensions and sizes of all such piping, ductwork, and equipment for future use by the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that areas are ready to accept Work.
3.02 PROTECTION

A. Special care shall be taken for the protection of equipment furnished by this Contractor. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.

B. Protection of equipment during the plastering and painting of the building shall be the responsibility of the Contractor performing that work, but this shall not relieve this Contractor of the responsibility of checking to assure that adequate protection is being provided.

C. Where the installation or connection of equipment requires this Contractor to work in areas previously finished by other Contractors, this Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. This Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.

D. When heavy materials must be placed upon or transported over the roof deck, sheeting shall be placed to distribute weight and support such materials. Any damage shall be immediately corrected at no cost to the owner.

3.03 ACTIVE SERVICES

A. Existing active utility services: water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to utility or municipality with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

B. Temporary shutdowns shall be coordinated with the Owner to minimize the interruptions to the Owner's normal business activities.

C. Provide temporary cooling for electrical room as required during construction. Coordinate with Owner.

3.04 COORDINATION

A. The Mechanical Contractor shall coordinate Work with all other trades prior to installation. Some spaces are extremely tight and shall require careful cooperation.

B. No piping shall be run over the top of any electrical panels or electrical equipment.

C. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

D. Where the specifications state that equipment shall be "furnished", "installed", or "provided", it shall be understood to mean this Contractor shall furnish and install completely unless it is specifically stated that the equipment is to be furnished and/or installed by others.

3.05 OPENING, CUTTING, AND PATCHING

A. This Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of Work, and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

B. This Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings, but this shall not relieve this Contractor of the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to this Contractor's failure to inspect this work, then this Contractor shall make arrangements for the patching required to properly close the openings, to include patch painting, and this Contractor shall pay any additional cost incurred in this respect.
C. When cutting and patching of the structure is made necessary due to this Contractor's failure to install piping, ducts, sleeves or equipment on schedule, or due to this Contractor's failure to furnish, on schedule, the information required for the leaving of openings, then it shall be this Contractor's responsibility to make arrangements for this cutting and patching and this Contractor shall pay any additional cost incurred in the correction.

3.06 WIRING FOR MECHANICAL EQUIPMENT
A. Division 26 Contractor will provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches and final connections.
B. This Contractor will be responsible for internal wiring, alarm wiring, control wiring or interlock wiring for equipment furnished by him to include temperature control wiring.
C. Division 26 Contractor will furnish motor starters for motors furnished by this Contractor, except where other Sections call for starters to be furnished by them.
D. This Contractor shall furnish to the Division 16 Contractor shop drawings and a schedule for all motors and other mechanical equipment which require electrical services. The schedule shall include the exact locations for rough-ins, electrical loads, size, and electrical characteristics for all services required.
E. Where motors or equipment furnished by this Contractor require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, due to this Contractor furnishing substitute equipment, then additional cost in this respect shall be paid for by this Contractor.
F. This Contractor shall review the Electrical Drawings and shall call to the attention of the Engineer, prior to bidding, omissions of electrical services required for equipment, and shall verify extent of Electrical Contractor's work.

3.07 EQUIPMENT INSTALLATION
A. Erect equipment in neat and workmanlike manner, align, level and adjust for satisfactory operation, install so that connecting and disconnecting of piping and accessories can be made readily and so that all parts are easily accessible and removable for inspection, operation and maintenance.

3.08 NOISE AND VIBRATION
A. Mechanical equipment shall operate without objectionable noise or vibration as determined by the Engineer. If such objectionable noise or vibration should be produced and transmitted to occupied portions of the building by apparatus, piping, ducts or other parts for the mechanical work, make necessary changes and additions, as approved, without extra cost to the Owner.

3.09 PAINTING AND IDENTIFICATION
A. Painting
1. Paint in accordance with Section 09 9000 - Paints and Coatings.
B. Identification
1. Identify valves and dampers with stamped metal tags. Information on tags to include system information, valve number and other pertinent coding marks that coordinate with the drawings, ducts or schedules.
2. Provide Owner with a schedule listing valve and damper number and their location.
3. Identify piping systems on both sides of wall, floor and ceiling penetrations, and pipe shafts with color coded markers identifying pipe contents and direction of flow. Markers shall be affixed to pipes at valves used by operators (hose stations, etc.) near connections of pumps and equipment and at intervals not exceeding 20 feet.
4. Proposed markers and samples shall be submitted to Engineer for approval.
5. Color coding and labeling shall match existing or in accordance with the latest edition of ANSI/ASME A13.1.

3.10 TEST AND DEMONSTRATION
A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
B. Prior to acceptance of the mechanical installation, the Contractor shall demonstrate to the Owner or their designated representatives all essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems.

C. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instructions and shall arrange to have the manufacturer's representatives for the system present to assist with the demonstrations. The Owner and Contractor shall each sign a certification stating that the training has been performed and the Owner accepts same.

3.11 SITE

A. The site shall be kept orderly and reasonably clean at all times during construction. At the conclusion of the construction, the site shall be cleaned thoroughly of all rubble, debris, and unusual materials.

B. All tunnels, chases, and closed-off spaces shall be cleaned of all waste materials, wood framing, and other construction materials.

C. The storing of all materials during construction shall be as directed by the Owner in areas designated for that purpose.

END OF SECTION 22 0500
SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Jackets and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS
A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.07 WARRANTY
A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.
2.02 GLASS FIBER
A. Manufacturers:
   1. CertainTeed Corporation.
   3. Owens Corning Corp.
   4. Engineer approved equivalent
B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.
C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
D. Vapor Barrier Lap Adhesive: Compatible with insulation.
E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 CELLULAR GLASS
A. Manufacturers:
   1. Pittsburgh Corning Corporation

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION
A. Manufacturer:
   1. Aeroflex USA, Inc
   2. Armacell LLC; AP Armaflex
   3. K-Flex USA LLC; Insul-Tube
   4. Engineer Approved Equivalent
B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS
A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation
      b. Engineer approved equivalent.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that piping has been tested before applying insulation materials.
B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

H. Neatly finish insulation at supports, protrusions, and interruptions.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Cold Water, W2
      a. Glass Fiber Insulation:
         1) Pipe Size Range: Up to 3" inch.
         2) Thickness: 1 inch thickness with vapor barrier jacket.
   2. Roof Drain Bodies
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes inch.
         2) Thickness: 1 inch thickness with vapor barrier jacket.
   3. Horizontal Storm Drainage
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes inch.
         2) Thickness: 1 inch thickness with vapor barrier jacket.

END OF SECTION 22 0719
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Domestic water, W2.
   2. Flanges, unions, and couplings.
   3. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS
A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
B. Section 22 0719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS
A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
H. AWWA C651 - Disinfecting Water Mains.
I. NSF 61 - Drinking Water System Components - Health Effects.
J. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE
A. Perform Work in accordance with the State of Iowa Standards and all local plumbing codes.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 DOMESTIC WATER, W2 PIPING, ABOVE GRADE
A. Copper Tube: ASTM B 88 (ASTM B 88M), Type K (A) in partitions and concealed above ceiling, Type L elsewhere, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 forged steel slip-on flanges.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges or Victaulic couplings.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end or Victaulic Clearflo, water impervious isolation barrier.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges, unions, or grooved couplings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
H. Slope water piping and arrange to drain at low points.
I. Provide access where valves and fittings are not exposed.
J. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

3.03 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.
B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric). 
C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
E. Maintain disinfectant in system for 24 hours.
F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 22 1005
SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Nameplates.
   B. Tags.
   C. Pipe markers.

1.02  SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.
   B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
   C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
   D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2  PRODUCTS
2.01  IDENTIFICATION APPLICATIONS
   A. Air Handling Units, Condensing Units, control panels, thermostats: Nameplates.
   B. Dampers: Tags
   C. Piping: Pipe markers.
   D. Thermostats: Nameplates.

2.02  NAMEPLATES
   A. Manufacturers:
      1. Advanced Graphic Engraving, LLC
      2. Brimar Industries, Inc
      3. Craftmark Pipe Markers
      4. Kolbi Pipe Marker Co
      5. Seton Identification Products
      6. Substitutions: See Section 01 6000 - Product Requirements.

2.03  TAGS
   A. Manufacturers:
      1. Advanced Graphic Engraving
      2. Brady Corporation
      3. Brimar Industries, Inc
      4. Craftmark Pipe Markers
      5. Kolbi Pipe Marker Co
      6. Substitutions: See Section 01 6000 - Product Requirements.
      B. Metal Tags: Stainless Steel with stamped letters; minimum text height 3/8", tag size minimum 1-1/2 inch rectangular with smooth edges.

2.04  PIPE MARKERS
   A. Manufacturers:
      1. Brady Corporation
      2. Brimar Industries, Inc
      3. Craftmark Pipe Markers
      4. Kolbi Pipe Marker Co
      5. Seton Identification Products
6. Substitutions: See Section 01 6000 - Product Requirements.
B. Coordinate text and colors with Owner's standard.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Suitable for interior and exterior use. Single row of direction arrows indicating flow direction wrapped around pipe at each end of label. Section arrow and identification of fluid being conveyed.

PART 3 EXECUTION

3.01 PREPARATION
A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION
A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with stainless steel chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.

END OF SECTION 23 0553
SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Testing, adjustment, and balancing of air systems.
B. Measurement of final operating condition of HVAC systems.
C. Commissioning activities.

1.02 REFERENCE STANDARDS
D. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems.
E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   8. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
   9. Test Reports: Indicate data on AABC MN-1 forms.
10. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Engineer.
   g. Project Contractor.
   h. Report date.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building
   3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work
   prior to Substantial Completion of the project.

C. Additional Tests:
   1. Seasonal Periods: If initial TAB procedures were not performed during near peak summer
      and winter conditions, perform additional TAB during near-peak summer and winter
      conditions.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this
      section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council
      b. NEBB, National Environmental Balancing Bureau
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management
         Institute

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following
   conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final
      filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system
   balance.

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and
   plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to
   space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.
B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to
be restored. Set and lock memory stops.
C. After adjustment, take measurements to verify balance has not been disrupted or that such
disruption has been rectified.
D. Leave systems in proper working order, replacing belt guards, closing access doors, closing
doors to electrical switch boxes, and restoring thermostats to specified settings.
E. At final inspection, recheck random selections of data recorded in report. Recheck points or
areas as selected and witnessed by the Owner.

3.05 AIR SYSTEM PROCEDURE
A. Adjust air handling and distribution systems to provide required or design supply, return, and
exhaust air quantities at site altitude.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of
duct.
C. Measure air quantities at air inlets and outlets.
D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts
and noise.
E. Use volume control devices to regulate air quantities only to extend that adjustments do not
create objectionable air motion or sound levels. Effect volume control by duct internal devices
such as dampers and splitters.
F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required.
Vary branch air quantities by damper regulation.
G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops,
and total pressure across the fan. Make allowances for 50 percent loading of filters.
H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design
conditions.

3.06 COMMISSIONING
A. See Sections 01 9113 - General Commissioning Requirements and 23 0800 for additional
requirements.
B. Perform prerequisites prior to starting commissioning activities.
C. Fill out Prefunctional Checklists for:
   1. Air side systems.
D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the
final TAB report.
E. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been
      permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting
design loads, less diversity; this shall include a review of TAB methods, established control
setpoints, and physical verification of at least one leg from fan to diffuser having all
balancing dampers wide open and that during full cooling of all terminal units taking off
downstream of the static pressure sensor, the terminal unit on the critical leg has its damper
90 percent or more open.

3.07 SCOPE
A. Test, adjust, and balance the following:
   1. Air Handling Units
   2. Fans.
   3. Air Inlets and Outlets.

3.08 MINIMUM DATA TO BE REPORTED
A. Air Moving Equipment:
1. Equipment tag number and name.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Arrangement/Class/Discharge.
7. Air flow, specified and actual.
8. Return air flow, specified and actual.
9. Outside air flow, specified and actual.
10. Total static pressure (total external), specified and actual.
11. Inlet pressure.
12. Discharge pressure.
14. Number of Belts/Make/Size.
15. Fan RPM.

B. Air Inlets and Outlets:
1. Room number/location.
2. Inlet or outlet type.
3. Inlet or outlet size.
4. Design air flow.
5. Test (final) air flow.
6. Percent of design air flow.

END OF SECTION 23 0593
SECTION 23 0713
DUCT INSULATION

PART 1  GENERAL

1.01  SECTION INCLUDES
A.  Duct insulation.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
A.  See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B.  Product Data:  Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04  DELIVERY, STORAGE, AND HANDLING
A.  Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B.  Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05  FIELD CONDITIONS
A.  Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B.  Maintain temperature during and after installation for minimum period of 24 hours.

PART 2  PRODUCTS

2.01  REGULATORY REQUIREMENTS
A.  Surface Burning Characteristics:  Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02  GLASS FIBER, FLEXIBLE
A.  Manufacturer:
   1.  CertainTeed Corporation
   2.  Johns Manville
   3.  Knauf Insulation
   4.  Owens Corning Corporation
   5.  Substitutions:  See Section 01 6000 - Product Requirements.
B.  Insulation:  ASTM C 553; flexible, noncombustible blanket.  ASTM C 612; commercial grade.
   1.  'K' value:  0.23 at 75 degrees F, when tested in accordance with ASTM C518.
   3.  Maximum Air Velocity:  Coated air side for 4000 ft min.
   4.  Foil Scrim Facing:  0.002 inch for air conditioning ducts.
   5.  Maximum Water Vapor Absorption:  5.0 percent by weight.
C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Johns Manville
   2. Knauf Insulation
   3. Owens Corning Corporation
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. ‘K’ Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Foil Scrim Facing: 0.002 inch for air conditioning duct.
   3. Maximum Service Temperature: 450 degrees F.
   4. Maximum Water Vapor Absorption: 5.0 percent.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation with vapor barrier jackets.

D. Finish with tape and vapor barrier jacket.

E. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

F. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

3.03 SCHEDULES

A. Outside air ducts and plenums:
   1. Rigid Glass Fiber Duct Insulation: 3 inches thick, 3 PCF with FSK jacket.

B. Supply Ducts
   1. Flexible Glass Fiber Duct Wrap Insulation: 2 inches thick, 1.5 PCF with FSK jacket.

END OF SECTION 23 0713
SECTION 23 0719
HVAC PIPING INSULATIONS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Piping insulation.
B. Flexible removable and reusable blanket insulation.
C. Jackets and accessories.

1.02  RELATED REQUIREMENTS
A. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2  PRODUCTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02  FLEXIBLE ELASTOMERIC CELLULAR INSULATION
A. Manufacturer:
   1. Aeroflex USA, Inc; Aerocel ULP
   2. Armacell LLC; AP Armaflex
   3. K-Flex USA LLC; K-Flex Titan
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.

2.03  JACKETS
A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
C. Paint exterior refrigerant piping with compatible epoxy paint and let dry before installing insulation and jacket.

3.03 SCHEDULE

A. Cooling Systems:
   1. Refrigerant Suction and Refrigerant Liquid:
      a. Less than 1/2" diameter: 1/2" thick elastomeric
      b. 1" diameter and larger: 1" thick elastomeric.
      c. Cover insulated interior pipe with PVC jacket.
      d. Cover insulated exterior pipe with aluminum jacket.
SECTION 23 0800
COMMISSIONING OF HVAC

PART 1  GENERAL

1.01  SUMMARY
A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Air handling units.
   2. Exhaust and supply fans.
   3. Motorized dampers.
   4. Air cooled condensing units
   5. Controls
   6. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
A. Updated Submittals:  Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Prefunctional Checklists and Functional Test Procedures for Control System:  Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of performing operational checks of each controlled component.
      c. Plan and process for calibrating valve and damper actuators and all sensors.
      d. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work.  Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs:  Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements.  In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system.  Provide an index and clear table of contents.  Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built sequence of operations for each piece of equipment.
COMMISSIONING OF HVAC

E. Project Record Documents: See Section 01 7800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT
A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION
A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
B. Furnish additional information requested by the Commissioning Authority.
C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.
F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
3.02 INSPECTING AND TESTING - GENERAL
A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
C. Damper Stroke Setup and Check:
   1. Set air handling units and fans to normal operating mode.
   2. Verify that dampers and end switches associated with air handling units or fans operate as described in the Contract Documents.
   3. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
E. Seasonal Periods: If initial commissioning procedures were not performed during near-peak summer and winter conditions, perform additional commissioning during near-peak summer and winter conditions.

3.03 TAB COORDINATION
A. Coordinate commissioning schedule with TAB schedule.
B. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
C. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.
D. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING
A. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
B. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
C. Functional Testing of the control system constitutes demonstration.
D. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
E. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.
F. Demonstrate to the Commissioning Authority:
   1. That all specified pilot lights, indication and alarms features are set up, debugged and fully operable.
   2. Functionality of remote panels or thermostats.
   3. Occupant over-rides (manual, telephone, key, keypad, etc.).
   4. O&M schedules and alarms.
   5. Occupancy sensors and controls.
   6. All control strategies and sequences not tested during controlled equipment testing.
G. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.
3.05 OPERATION AND MAINTENANCE MANUALS
A. See Section 01 7800 for additional requirements.
B. Add design intent documentation furnished by Engineer to manuals prior to submission to Owner.
C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING
A. Demonstrate operation and maintenance of HVAC system to Owner’s personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
C. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION 23 0800
SECTION 23 0913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Control panels.
B. Dampers.
C. Damper Operators:
D. Thermostats:
   1. Electric room thermostats.
E. Temperature Controller and remote outdoor air temperature sensor
F. Relays

1.02  RELATED REQUIREMENTS
A. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.
B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03  REFERENCE STANDARDS
A. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats.

1.04  SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences.
D. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.05  QUALITY ASSURANCE
A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06  WARRANTY
A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2  PRODUCTS

2.01  EQUIPMENT - GENERAL
A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02  CONTROL PANELS
A. NEMA 12 painted steel general purpose utility enclosure with interior back panel, hinged door and key-lock latch.
B. Panel shall be sized as required to include at a minimum:
   1. (1) 120 VAC circuit breaker
   2. Control Relays as required.
   3. Honeywell Model 7775B2016 controller with remote T775-SENS-OAT sensor or equal.
   4. Fused Terminal blocks as required.
5. UL listed, NEMA rated terminal blocks minimum 15A continuous current, screw-secured 24-12 Gauge wire acceptance.
6. Other devices as required by the sequence of operation shown on the drawings.

2.03 DAMPERS
A. See Section 23 3300 - Air Duct Accessories

2.04 DAMPER OPERATORS
A. See Section 23 3300 - Air Duct Accessories

2.05 THERMOSTATS
A. Electric Room Thermostats:
   1. Low voltage, adjustable room thermostat to control air handling unit and condensing unit.
   2. Room thermostat display shall include:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. Day of week.
      e. System mode indication: cooling, auto, off, fan auto, fan on.
B. Temperature controller and remote outdoor air temperature sensor:
   1. Honeywell Model 7775B2016 with T775-SENS-OAT, or equal.

2.06 RELAYS
A. All control relays shall be plug-in style, provided with dust protecting enclosure and identical, 11 blade plug-in bases with screw terminals. All relays in all panels shall be standardized as much as possible to one or minimum number of relay manufacturers and models.
B. Relays shall have an indication flag to indicate the energized status of the relay.
C. 120 VAC, Minimum 3 pole double throw, 10 amp contacts.
D. Any relay whose operating frequency would indicate a life of less than twenty years, shall be solid state, either plug-in as above, or with screw terminals.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that systems are ready to receive work.
C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
E. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor.
C. Mount outdoor air sensors indoors, with sensing elements outdoors with sun shield.
D. Mount control panel on wall. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
E. Install thermostats, wiring and all controls necessary for complete installation and operation.
F. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 23 0913
SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping.
B. Moisture and liquid indicators.
C. Strainers.
D. Filter-driers.
E. Solenoid valves.
F. Expansion valves.

1.02 RELATED REQUIREMENTS
A. Section 23 0719 - HVAC Piping Insulations.

1.03 REFERENCE STANDARDS
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
C. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
D. ASTM B32 - Solder Metal.
G. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

1.04 SUBMITTALS
A. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturers catalog data including load capacity.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store piping and specialties in shipping containers with labeling in place.
B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Comply with ASME B31.9 for installation of piping system.

2.02 PIPING
A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

2.03 MOISTURE AND LIQUID INDICATORS
A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 FILTER-DIERS
A. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
B. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.
C. Replaceable Cartridge Angle Type:
   1. Shell: ARI 710, UL listed, brass removable cap for maximum working pressure of 350 psi.
D. Permanent Straight Through Type:
   1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION
   A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
   B. Remove scale and dirt on inside and outside before assembly.
   C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION
   A. Install refrigeration specialties in accordance with manufacturer's instructions.
   B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
   C. Install piping to conserve building space and avoid interference with use of space.
   D. Provide non-conducting dielectric connections when joining dissimilar metals.
   E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   F. Pipe Hangers and Supports:
      1. Install in accordance with ASME B31.5.
      2. Support horizontal piping as indicated.
      3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
      4. Place hangers within 12 inches of each horizontal elbow.
   G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
   H. Provide clearance for installation of insulation and access to valves and fittings.
   I. Insulate piping; refer to Section 23 0716. Paint pipe with epoxy paint and let dry before covering with insulation.
   J. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
   K. Fully charge completed system with refrigerant after testing.

END OF SECTION 23 2300
SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Metal ductwork.

1.02  RELATED REQUIREMENTS
   A. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
   B. Section 23 0713 - Duct Insulation.
   C. Section 23 3300 - Air Duct Accessories.
   D. Section 23 3700 - Air Outlets and Inlets.

1.03  REFERENCE STANDARDS
   A. ASME AG-1 - Code on Nuclear Air and Gas Treatment.
   G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.04  SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
   B. Product Data: Provide data for duct materials.
   C. Submit ductwork layout drawings for the entire ductwork system, drawn at the same scale as the Contract Drawings, double line, indicating duct dimensions, fittings, accessories, elevations, clearance to structure, etc. Do not install ductwork without approval of shop drawings by engineer.
   D. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.
   E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05  FIELD CONDITIONS
   A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
   B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2  PRODUCTS

2.01  DUCT ASSEMBLIES
   A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

2.02  MATERIALS
   B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
C. Hanger Rod: stainless steel; threaded both ends, threaded one end, or continuously threaded.
D. Fasteners: Rivets, bolts, or sheet metal screws.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Construct T’s, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation. Weld medium and high pressure ducts in place.
D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install, support, and seal ducts in accordance with SMACNA (DCS).
B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
G. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
H. At exterior wall louvers, seal duct to louver frame.

END OF SECTION 23 3100
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Duct access doors.
B. Fire dampers.
C. Flexible duct connectors.
D. Volume control dampers.
E. Automatic control dampers.
F. Damper operators.

1.02 RELATED REQUIREMENTS
A. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS
B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.
C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service.
D. UL 555 - Standard for Fire Dampers.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers and duct access doors. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 DUCT ACCESS DOORS
A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc
   2. Ductmate Industries, Inc, a DMI Company
   3. Elgen Manufacturing Company, Inc
   4. Lloyd Industries, Inc
   5. MKT Metal Manufacturing
   6. Air Balance.
   7. Nailor Industries Inc
   8. Ruskin Manufacturing
   9. Semco, Inc
   10. Ward Industries
B. Fabricate in accordance with SMACNA (DCS) and as indicated.
C. Fabrication: Rigid and close-fitting material to match ductwork with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 by 48 inches and larger: Three hinges and two compression latches with outside and inside handles.
D. Access doors with sheet metal screw fasteners are not acceptable.

2.02 FIRE DAMPERS
A. Manufacturers:
   1. Louvers & Dampers, Inc
   2. Nailor Industries, Inc
3. NCA, a brand of Metal Industries Inc
4. Pottorff
5. Ruskin
6. Engineer approved equivalent.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.03 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

2.04 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Cesco Products
   2. Greenheck
   3. Louvers & Dampers, Inc
   4. Nailor Industries, Inc
   5. NCA
   6. Pottorff Brand
   7. Ruskin Company
   8. United Enertech
   9. Engineer approved equivalent.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch. Construction shall be of the same material as the duct in which the damper is installed.

D. Multi-Blade Damper: Construction shall be of the same material as the duct in which the damper is installed.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.05 CONTROL DAMPERS

A. Manufacturers:
   1. Cesco Products
   2. Greenheck
   3. Louvers & Dampers, Inc.
   4. Nailor Industries Inc.
   5. Pottorff
   6. Ruskin Company
   7. Engineer approved equivalent.

B. Performance: Test in accordance with AMCA 500-D.
C. Frames: Extruded aluminum, welded, minimum 12 gage.
D. Blades: Extruded aluminum, maximum blade size 6 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.
E. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.
F. Jamb Seals: Spring stainless steel.
G. Shaft Bearings: Lubricant free, stainless steel, single row, ground, flanged, radial, antifriction type with extended inner race.
H. Linkage Bearings: Graphite impregnated nylon.
I. Leakage: AMCA - Class 1A. Leakage less than 3 cfm/sq.ft. based 1 inch w.g. and an approach velocity of 2000 fpm.

2.06 DAMPER OPERATORS
A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
B. Electric Operators:
1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
B. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
C. Demonstrate re-setting of fire dampers to Owner's representative.
D. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.
E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 3300
SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Diffusers:
B. Registers/grilles:

1.02 REFERENCE STANDARDS
B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.
C. ARI 650 - Air Outlets and Inlets.
D. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.
G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2  PRODUCTS

2.01 MANUFACTURERS
A. Carnes
B. Krueger
C. Price Industries
D. Titus
E. Tuttle and Bailey
F. Engineer approved equivalent.
G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUPPLY REGISTERS/GRILLES
A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with one-way deflection.
B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
C. Fabrication: Aluminum extrusions with factoryclear lacquer finish. Stainless steel when installed in stainless steel ductwork or where indicated on the drawings.

2.03 EXHAUST AND RETURN REGISTERS/GRILLES
A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
B. Frame: 1-1/4 inch margin with countersunk screw mounting.
C. Fabrication: Aluminum extrusions with factory finish. Stainless steel when installed in stainless steel ductwork.

PART 3  EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Comply with SMACNA (ASMM) for flashing/counter-flashing of wall penetrations.
C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
D. Install diffusers to ductwork with air tight connection.
E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

3.02 AIR OUTLET AND INLET SCHEDULE
A. As scheduled on project plans.

END OF SECTION 23 3700
SECTION 23 6213
PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Condensing unit package.
B. Charge of refrigerant and oil.
C. Controls and control connections.
D. Refrigerant piping connections.
E. Motor starters.
F. Electrical power connections.

1.02 REFERENCE STANDARDS
B. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
C. AHRI 365 (I-P) - Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units.
D. ARI 520 - Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units.
H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
I. NEMA MG 1 - Motors and Generators.
J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical.
K. Contractor to refer to those codes and standards that pertain to this section of the specification. All codes and standards may or may not be listed, but it shall be the Contractor's responsibility to refer to latest editions of such and coordinate related work as necessary.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide rated capacities, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.
C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.
D. Wiring diagrams - Power, signal and control wiring.
E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
F. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.
G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
1.05 DELIVERY, STORAGE, AND HANDLING
A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
B. Provide a five year warranty to include coverage for refrigerant compressors.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide a five year warranty to include coverage for refrigerant compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Carrier
B. Daiken
C. The Trane Company.
D. York International / Johnson Controls.
E. Engineer approved equivalent.

2.02 MANUFACTURED UNITS
A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral subcooling coil, controls, liquid receiver, wind deflector, and screens.
B. Construction and Ratings: In accordance with AHRI 210/240. Test in accordance with ASHRAE Std 23.1.
C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.

2.03 CASING
A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.
B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.
C. Provide removable access doors or panels with quick fasteners and piano hinges.

2.04 CONDENSER COILS
A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.
B. Condenser coils shall be protected with Heresite coating.
C. Coil Guard: Expanded metal with lint screens.

2.05 FANS AND MOTORS
A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.
B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in current and thermal overload protection.

2.06 COMpressors
A. Compressor: Hermetic scroll type.
B. Mounting: Statically and dynamically balance rotating parts and mount on spring vibration isolators.
C. Lubrication System: Centrifugal oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.
D. Motor: Constant speed 3600 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.

E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.

F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

2.07 REFRIGERANT CIRCUIT

A. Provide each unit with two independent refrigerant circuits, factory supplied and piped. Refer to Section 23 2300.

B. For each refrigerant circuit, provide:
   1. Filter dryer replaceable core type.
   2. Liquid line sight glass and moisture indicator.
   3. Thermal expansion valve for maximum operating pressure.
   4. Insulated suction line.
   5. Suction and liquid line service valves and gauge ports.
   6. Liquid line solenoid valve.
   7. Charging valve.
   8. Discharge line check valve.
   9. Compressor discharge service valve.
   10. Condenser pressure relief valve.

2.08 CONTROLS

A. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, molded case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.

C. Provide safety controls arranged so any one will shut down machine:
   1. High discharge pressure switch (manual reset) for each compressor.
   2. Low suction pressure switch (automatic reset) for each compressor.
   3. Oil Pressure switch (manual reset).

D. Provide the following operating controls:
   1. Thermostat located in room cycles compressors activates cylinder unloaders.
   2. Five minute off timer prevents compressor from short cycling.
   3. Periodic pump-out timer to pump down on high evaporator refrigerant pressure.

E. Gauges: Prepiped for suction and discharge refrigerant pressures and oil pressure for each compressor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

C. Install thermostats, wiring and all controls necessary for complete installation and operation.

D. Provide for connection to electrical service. Refer to Section 26 0583.

E. Install units on vibration isolation. Refer to Section 22 0548.

F. Install thermostats, wiring and all controls necessary for complete installation and operation.

G. Provide connection to refrigeration piping system and evaporators. Refer to Section 23 2300. Comply with ASHRAE Std 15.
3.02 SYSTEM STARTUP

A. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

B. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

C. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

D. Provide initial start-up, cooling season start-up, and winter season shut-down for first year of operation, including routine servicing and check out.

END OF SECTION 23 6213
SECTION 23 7313
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Casing construction.
B. Fan section.
C. Coil section.
D. Filter section.

1.02 REFERENCE STANDARDS
B. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.
E. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
F. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.
I. ARI Guideline D - Application and Installation of Central Station Air-Handling Units; Air-Conditioning and Refrigeration Institute; 1996.
J. NEMA MG 1 - Motors and Generators.
K. NFPA 70 - National Electrical Code.
M. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
N. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
Q. Contractor to refer to those codes and standards that pertain to this section of the specification. All codes and standards may or may not be listed, but it shall be the Contractor's responsibility to refer to latest editions of such and coordinate related work as necessary.

1.03 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data:
1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
D. Manufacturer's Instructions: Include installation instructions.
E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.05 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Car
B. Daikin Applied
C. Trane
D. York / Johnson Controls
E. Engineer approved equivalent.

2.02 GENERAL DESCRIPTION
A. Unit is a 100% return air system for cooling of an electrical room. Fabricate draw-thru type air handling units suitable for low pressure operation.
B. Configuration: Fabricate with fan plus accessories, including:
   1. Cooling coil section.
   2. Filter section.
C. Fabrication: Conform to AMCA 99 and ARI 430.

2.03 CASING CONSTRUCTION
A. Full Perimeter Base Rail:
   2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.
B. Casing:
   1. Construct of one piece, insulated, double wall panels.
   2. Provide mid-span, no through metal, internal thermal break.
   3. Construct outer panels of galvanized steel and inner panels of stainless steel.
   4. Casing Air Pressure Performance Requirements:
      a. Able to withstand up to 8 inches w.g. positive or negative static pressure.
C. Access Doors:
   1. Construction, thermal and air pressure performance same as casing.
   2. Provide surface mounted handles on hinged, swing doors.
D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.
E. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

F. Insulation:
   1. Provide minimum thermal thickness of 13 R throughout.
   2. Completely fill panel cavities in each direction to prevent voids and settling.
   3. Comply with NFPA 90A.

G. Drain Pan Construction:
   1. Provide cooling coil sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
   2. Slope in two planes to promote positive drainage and eliminate stagnant water conditions.
   3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
   4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

2.04 FANS

A. Direct drive plenum fans with integral frame motors, shall be mounted on isolation bases. Fan shall be dynamically balanced throughout the operating range to a BV-3 (0.20 in/s) per AMCA 204 test standard. Fan and motor shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return ductwork, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

B. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.

C. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

D. Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.

2.05 MOTORS AND DRIVES

A. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.

B. Fan Motors shall be heavy duty, open drip-proof operable at scheduled voltage. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.

C. Direct driven fans utilizing integral frame motors shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

D. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

2.06 COILS

A. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
B. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.

C. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

D. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

E. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

F. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.

G. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.

H. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

I. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, insides of tubes shall be air dried, charged with dry nitrogen or dry air, and sealed to prevent contamination.

J. Refrigerant suction and liquid headers shall be constructed from copper tubing. Suction and liquid connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.

K. Tubes shall be 1/2-inch with aluminum fins.

L. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

M. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

N. Hersite coating on refrigerant coils.

2.07 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Pleated Media Filters:
   1. Media: 2 inch, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
   2. Frame: Steel wire grid.
   3. Minimum Efficiency Reporting Value: MERV 8 when tested in accordance with ASHRAE Std 52.2.

C. Differential Pressure Gauge:
   1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Verify the modular unit dimensionally fits in mechanical space indicated on Drawings.
C. Bolt sections together with gaskets.
D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
E. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 22 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
F. Provide fixed sheaves required for final air balance.
G. Provide access sections as indicated on Drawing.
H. Make connections to coils with unions or flanges.

3.02 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.
B. Prepare and start equipment and systems in accordance with manufacturers’ instructions and recommendations.
C. Adjust for proper operation within manufacturer's published tolerances.

END OF SECTION 23 7313
SECTION 25 1300
INSTRUMENTATION AND CONTROL INTEGRATION

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Integration of instrumentation and control system, provided by a single systems integrator, furnishing and activating items specified in Sections 25 1300, 25 1316, 25 3100, 25 9110, and 25 9120.

1.02  SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. The Submittals shall consist of legible printed text, high quality drawings, and manufacturer's catalog data bound in an electronic PDF (indexed, book marked, and searchable), that identify major sections of the document. The Submittals shall address all hardware and software to be supplied.

C. The Submittals shall contain:
   1. Identification of the respective responsibilities of each party to the project, including what is provided by the system manufacturer, what is to be subcontracted, etc.
   2. Description of the major user related features and operating characteristics of the proposed system.
   3. Description of all master site hardware and software, including examples of digital displays, and how the operator will interface with the system to achieve each specified function.
   4. Describe the training program. An outline shall be provided that covers the basic software and hardware training, operator training, system maintenance training, and programming training. Identify the course content and the time spent on each subject area.
   5. Describe the startup implementation plan, participants' responsibilities and a schedule of events.
   6. All significant equipment to be supplied shall be listed, followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied, and any special setup and operation and maintenance characteristics.
   7. Drawings of equipment to be supplied shall include as a minimum, overall dimensions and details for each unit, including installation arrangements, door mounted operator devices, and instruments. Wiring diagrams of all system components, including field device connections, shall be included and specific installation wiring responsibilities identified.
   8. Detailed factory and field test procedures at least two weeks before scheduled testing.
   9. Recommended maintenance, special tools, and test equipment.
  10. Hardware configuration block diagrams.

D. Operation and maintenance manuals.

1.03  MAINTENANCE MANUALS AND RECORD DRAWINGS

A. O&M Manuals shall be provided as specified in Section 01 7800. In addition to those requirements, specific additional details as indicated below shall be provided.

B. Provide detailed O&M manuals with complete information concerning the operation of the system and support necessary, with diagnostics down to the module and card replacement level.

C. Provide a detailed written description of system hardware, software, and system operation. The description of master site hardware and software shall identify pertinent references to sections of standard hardware and software manuals where operational procedures are detailed.

D. Submit four sets of complete O&M manuals with all project specific information in binders with indexed tab sections. Include manufacturer/supplier, contact and phone number for all equipment listed. Submit a digitized version of complete O&M manuals on disk or CD.

E. A listing of all recommended spare parts shall be included in the O&M manuals.
F. Data sheets shall be supplied for all significant equipment used in the system. The data sheet shall include, as a minimum, the component name, manufacturer, model number, quantity, and any special O&M characteristics.

G. Final record drawings of equipment shall be provided and as a minimum to include:
   1. Overall dimensions and details for all equipment and all door mounted operator devices including nameplate designations.
   2. Interconnecting wiring diagrams of all master station equipment, including field device connections.

H. Equipment and software manuals:
   1. Equipment list identifying components, model numbers, and release levels.
   2. Operation and maintenance data for each hardware and software component.
   3. Programming/configuration instructions for components.

I. Guides for locating faults, symptoms, possible causes of trouble, and suggested remedial action.

J. Detailed instructions on operation of utility programs.

K. Documents pertaining to factory and field testing efforts.

L. Equipment lists including manufacturer's name, part number, serial number, revision number, and recommended spare parts.

M. Communication parameters needed to interface with other computers (speed, number of data bits, parity, modem control, etc.).

1.04 WARRANTY

A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

1.05 MAINTENANCE CONTRACT

A. The Systems Integrator may offer the Owner a maintenance contract on the system.

B. The contract shall provide for recommended preventive maintenance, required emergency maintenance and the supply of all consumable items and parts of components which may fail during the life of the contract, and shall be dated to begin when the warranty period expires.

C. The Owner reserves the right to accept or reject the maintenance contract.

D. The maintenance contract cost shall not be included as part of this project, but shall be an item negotiated between Owner and systems integrator.

1.06 START-UP BY SERVICE REPRESENTATIVE

A. Provide qualified service representative to perform functions described in 01400 and the following.

B. Provide for equipment installation check, calibrations, control adjustments, startups, and other services in the field by qualified service representative to produce complete working installation in compliance with drawings and specifications, satisfactory to Owner and Engineer.

C. Provide field startup service at the project site.

D. This field service is to cover both the separate mounted instrumentation involved in the system and the various control panels and components.

E. Coordinate with General Contractor, Sub-Contractors and Equipment Suppliers to provide start-up services in concert with other equipment in the project.

F. In addition to the field services, arrange for Owner training to be performed by the Manufacturer in the use and maintenance of all instrumentation and control system equipment supplied. Refer to scheduled training requirements.

G. Provide complete start-up services until all systems are fully functional.

H. Any additional trips and/or days required by the Contractor before or after final startup and training shall not be charged to the Owner.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION
A. All units shall be installed in accordance with manufacturer's recommendations and Section 46 0500, and as indicated on drawings.
B. Units shall be installed and programmed by well qualified and experienced craftsmen and engineers/technicians.
C. Locations, orientations, and quantities as indicated on drawings.
D. Units shall be properly interfaced with the input and output devices.
E. Electrical and control wiring, cabling, conduits, connections, etc. shall be neatly installed.
F. Include all required and related items for a complete installation.
G. Manufacturer's shop coating and final finish, as per Section 09 9000, shall be compatible.
H. Support and anchor all units as per the manufacturer's recommendations and as indicated on drawings.

3.02 RESPONSIBILITY
A. The instrumentation and control integrator shall be responsible for coordination of the control center components, instrumentation, and supervisory controls with the process equipment installed.
B. Provide complete shop drawings and wiring diagrams.
C. PLC Programming:
   1. Existing Blended Sludge Mixing is comprised of 3 mixers and 2 of the 3 tanks have level measurement. New Blended Sludge Mixing will be comprised of 12 mixers distributed between the 3 tanks (as shown on plan sheets) and the existing submersible level transmitters in tanks 1 and 2 will be replaced with radar level transmitters with a radar level transmitter added to tank 3. Provide PLC programming for the modification and addition of equipment as described.
   2. Provide PLC programming for removal and replacement of equipment/instruments.
   3. Provide PLC programming and set points to control mixers for automatic operation based on tank level using mixer inhibit and restore set points per tank.
   4. Provide PLC programming for mixers and tanks status and alarming. Status/Alarms to include individual HOA Hand-Off-Auto selector switch positions, individuual mixer running-off-alarm, and Individual tank high and low level alarms/set points.
   5. Provide PLC programming to modify tank level interlocks for blended sludge pumps. Pump intakes will be modified under a separate project to allow sludge pumps to pump from multiple blended sludge tanks. Pump control loops will require modification to add selection of assigned tanks for interlocking and control. Coordinate with Owner on necessary selection and interlocking modifications.
   6. Existing hauled waste tank level is monitored by a bubbler panel that includes both pressure switches and transmitter in addition to a radar level transmitter. The bubbler system is being removed along with the existing radar level transmitter. Two new radar level transmitters will be installed as part of this project. Provide PLC programming for removal and replacement of equipment/instruments. Programming shall include a differential level alarm.
   7. Coordinate with Owner Staff prior to making any PLC program modifications.
D. SCADA Programming:
   1. Provide modifications and graphic edits to Owner's existing SCADA application.
   2. Seperate the exisiting combine blended sludge tank and blended sludge mixer screen into two, all new, separate overview screens.
   3. Status/Trending/Alarming for the following parameters:
      a. Individaul Tank Level - Status, Trending, and Alarming
      b. Individual Mixer HOA position - Status
      c. Individual Mixer Operation - Status and Alaming
d. Set Points - as described

e. Coordinate with Owner Staff prior to making SCADA graphic modifications.

E. To ensure an integrated and operational control system it is required that one system integrator shall supply all necessary control equipment and employ the personnel necessary to provide and support the complete system.

F. Service shall also be available 24 hours per day, 365 days per year.

3.03 SYSTEMS INTEGRATOR

A. Shall be an Allen-Bradley authorized systems integrator.

B. Shall have successfully configured and installed at least ten (10) networked systems of similar size, scope, and complexity in water/wastewater plant applications.

C. Shall provide project engineer for programming the PLCs and SCADA software on this project who is formally trained and experienced with Allen-Bradley and Wonderware or Intellution software.

D. Experience shall include multiple PLCs, networking on CAT 6 and fiber optic, WAN/LAN networks with multiple SCADA workstations, graphical screens, reporting, operating systems, etc.

E. Acceptable Systems Integrators:
   1. Jetco Inc., Altoona, IA.
   2. No Substitutes.

END OF SECTION 25 1300
SECTION 25 1316
BOXES, PANELS, AND CONTROL CENTERS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Control Panels.

1.02  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Submit panel layouts: Front and back.
C. Submit schematic diagrams, fully documented.
D. Product Data: Provide for all components.

1.03  WARRANTY
A. Full warranty against defects in materials and workmanship for one year after substantial
   completion, including all parts, labor, and expenses.

1.04  SERVICE REPRESENTATIVE
A. Provide qualified service representative to perform functions described in 01 4000 and to sign
   Certificate of Proper Inspection attached at end of Section 01 4000.

PART 2  PRODUCTS

2.01  HARDWARE AND COMPONENTS SPECIFICATIONS
A. This section shall specify various items of hardware, components, and equipment to be utilized in
   the controls system.
B. All panels shall be UL labeled for UL 508A. Panels with Intrinsic safe circuits shall be UL labeled
   for UL 698A in addition to 508A.
C. Adequate transient surge voltage protection shall be provided to protect the solid state
   equipment from voltage surges
D. All electrical components shall be UL approved and are to be of general purpose, heavy duty
   grade. Custom designed components not readily available from conventional industry sources
   shall not be used.

2.02  IDENTIFICATION
A. All components, door mounted and interior, shall be labeled.
B. Nameplates on the exterior of the panel shall be:
   1. For all equipment and panels:
      a. Location:
         1) Indoor: plastic, white text on black
         2) Outdoor: stainless steel with black enamel
      b. Min text height for nameplates shall be 3/8"
      c. All nameplates shall have lines as follows (contractor shall submit to WRA for approval
         prior to ordering):
         1) Line 1 – Full name of equipment or panel
         2) Line 2 – equipment tag
         3) Line 3 – which MCC bucket location or circuit power is fed from
   C. All components on the interior of the panel shall be labeled with nameplates permanent markings
      which shall identify the device, cross-referencing it with the schematic drawings.
   D. This shall include every relay, time delay, switch, and all other system components.
   E. All individual wires, both inside control panels/consoles and at each remote instrument or device,
      shall be wire tagged at each end with a unique number matching the wire number identification
      on the schematic. Wire tags shall be plastic heat shrunk tags, not paper.
F. Multiple conductor cable, such as ribbon cable with a permanent plug connector at each end, need not be marked.

2.03 SPARE PARTS
A. The following spare parts shall be provided:
   1. Two units or 10% of the total quantity of each used, whichever is greater, spare indicator lamps, relays and time delays of each type.
   2. Ten control fuses of each type and size.

2.04 CONTROL RELAYS
A. All control relays shall be plug-in style, provided with dust protecting enclosure and identical, 11 blade plug-in bases with screw terminals. All relays in all panels shall be standardized as much as possible to one or minimum number of relay manufacturers and models.
B. Relays shall have an indication flag to indicate the energized status of the relay.
C. Any relay whose operating frequency would indicate a life of less than twenty years, shall be solid state, either plug-in as above, or with screw terminals.

2.05 SWITCHES AND PUSHBUTTONS
A. All panel mounted rotary selector switches and pushbuttons shall be heavy duty, NEMA type 4/13, watertight/oiltight design, 30.5 mm, with screw-type termination.
B. Two-position, three-position, and four-position rotary selector switches are required as shown on the panel layout drawings and described in the functional description.
C. Include secondary contact block for use in transmitting switch position indication to control system and legend plates.
D. Approved manufacturers:
   2. Square D. Model: Class 9001 Type K.
   3. Engineer approved equivalent.

2.06 INDICATOR LIGHTS
A. All indicator lights shall be five-element LED type with lamp rated for illumination of 10,000 hour operating life. Dim glow lights are not a suitable alternate.
B. Power to the lamps shall be limited for extended operational life.
C. Lamps shall be replaceable from the front of the panel without the use of tools.
D. Lenses shall be screw-type to allow easy interchange for color coding selection, 30.5 mm.
E. All lamps shall be the same voltage, low voltage lamps, either 12V or 24V.
F. Provide integral push-to-test switch design.
G. Approved manufacturers:
   1. Allen-Bradley: Model: Bulletin 800T.
   2. Square D: Model: Class 9001 type J.
   3. Engineer approved equivalent.

2.07 CONTROL PANEL SURGE PROTECTION
A. Phoenix Contact Mains-Plugtrab PT series.
B. Engineer approved equivalent.

2.08 LOOP ISOLATION
A. Provide a surge protection device on all input and output circuits (analog, discrete, or digital communication) that enter or leave the building or structure in which the control panel is located.
B. Manufacturers:
   1. Innovative Technology Type OEM-D22.
   2. EDCO Type PC642.
2.09 CONTROL PANEL ELECTRICAL WORK

A. Wiring:
   1. Internal panel wiring shall be completed at the factory in a professional manner.
   2. Wiring shall be bundled in wire duct for ease of field modification or tracing, except for the required bundling with wire tires on the run to the door mounted components.
   3. All field interconnections shall be made to tubular clamp style terminal strips which shall be marked with the wire numbers of the connecting wires.

B. Materials and protection:
   1. All wire shall be stranded copper, of adequate ampacity in order to provide the rated operating voltage for all components under all extremes of operation.
   2. Wiring which carries low voltage signals subject to transients shall be protected by isolation and shielding.
   3. Insulation - Type MTW cabinet wiring.
   4. Insulation - Type THWN, THHN Field wiring.

C. Identification:
   1. Each wire shall be identified with an easily readable permanent wire marker, identifying the wire number. Numbering system shall be consistent throughout system, identifying all terminals.
   2. The "record" schematics shall identify that wire number for future maintenance requirements.
   3. An exception will be made for ribbon cable connectors which are provided with a permanent connector, providing the cables can be easily unplugged and reinstalled without confusion.

D. Connections and mounting:
   1. All devices, regardless of location in or on the panel, shall be mechanically mounted and electrically wired in a manner allowing easy removal, replacement, or exchange without requiring a soldering iron or special tools.
   2. All connections shall be of screw-type or plug-type connectors.

2.10 CONTROL PANEL

A. General
   1. Control panels shall include all items and components as indicated on drawings and specified herein. Provide all necessary internal components and power supplies necessary to perform all functions as previously described.
   2. Provide one duplex convenience outlet and one service light in each panel section.
   3. Electrical service to the control panel as indicated on drawings.
   4. Sufficient expansion space shall be provided in the enclosure to allow a ten percent expansion of the control system requirements. Five percent spare terminals shall be provided with the original installation and space for an additional five percent shall be available for later addition.
   5. Mounting track shall be provided for an expansion of up to ten percent additional relays.

B. Construction and finish:
   1. Control panels shall be manufactured from a UL listed, NEMA Type enclosure, all welded 14 gage cold rolled steel construction, with stainless steel door hardware, continuous piano hinge, and oil resistant gasket, except as specifically indicated otherwise. This specification for construction and finish is a minimum level. Provide the type of enclosure construction and finish as per the schedule in Section 25 9110, in Paragraph 2.02 "Control Panel Schedule."
   2. The exterior of the enclosure shall be phosphatized, then finished in baked enamel inside and outside. Except stainless steel enclosures, which shall not be coated.
   3. Inner panel shall be finished in white baked enamel.
   4. All cutouts shall be painted so that no raw metal is unprotected.
   5. Color chosen at time of approval of submittal.
   6. After final installation, any damage to the paint finish shall be retouched.
   7. Approved manufacturer:
PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and as indicated on Drawings.
B. Units shall be installed by well qualified and experienced technicians.
C. Units shall be properly interfaced with the input and output devices.
D. Include all required-related items for a complete installation.
E. Contractor shall be responsible for compatibility of manufacturer's shop coating and final finish.
F. Support and anchor all units as per the manufacturer's recommendations and as indicated on drawings.
G. Control panels shall be provided with an Underwriters Laboratories (UL) label certifying that the panels meet UL Rule 508A requirements and 698A when applicable. All work shall be in accordance with the National Electric Code and NEMA standards.
H. Repeat factory testing after field installation with field end elements. A minimum of one day of field inspection and testing by the manufacturer shall be provided. Field inspection and testing reports shall be provided to the Engineer.

END OF SECTION 25 1316
SECTION 25 3100
REMOTE INSTRUMENTS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Process Instruments (Electrical/Electronic)
   1. Level, Liquid, Microwave

1.02 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Submit legible printed text, high-quality user-related drawings, and manufacturer's catalog data bound in notebooks with index tabs that identify major sections of the document.
C. The submittal shall address all hardware and software to be supplied.
D. The submittal shall contain:
   1. Identification of the respective responsibilities of each party to the project, including what is provided by the system manufacturer, what is to be subcontracted, etc.
   2. Description of the major user related features and operating characteristics of the proposed system.
   3. Description of all master site hardware and software, including examples of digital displays, control loops, reports, and how the operator will interface with the system to achieve each specified function.
   4. Description and operation of all master configuration features of the I/O and local control loop characteristics.
   5. Description of the training program. An outline shall be provided that covers the basic software and hardware training, operator training, system maintenance training, and programming training. Identify the course content and the time spent on each subject area.
   6. Description of the startup implementation plan, participants' responsibilities and a schedule of events.
   7. All significant equipment to be supplied shall be listed, followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied, and any special setup and operation and maintenance characteristics.
   8. Drawings of equipment to be supplied shall include as a minimum, overall dimensions and details for each unit, including installation arrangements, door mounted operator devices, and instruments. Wiring diagrams of all system components, including field device connections, shall be included and specific installation wiring responsibilities identified.
E. Submit operations and maintenance manuals.

1.03 SERVICE REPRESENTATIVE
A. Provide qualified Service Representative to perform functions described in Section 01 4000, and to sign the Certification of Proper Inspection attached at the end of Section 01 4000.

1.04 WARRANTY
A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

PART 2  PRODUCTS

2.01 PROCESS INSTRUMENTS (ELECTRICAL/ELECTRONIC)
A. LEVEL, LIQUID, MICROWAVE
   1. General
      a. Function: Continuously measure, indicate, and transmit distance to liquid level surface.
      b. Type: Frequency-modulated, Continuous-wave microwave transceiver.
      c. Parts:
         1) Element
         2) Transmitter with Display
3) Antenna

2. Service:
   a. Type: Multiple installations and conditions; see schedule.
   b. Use: Multiple installations and conditions; see schedule.
   c. Process Temperature: approx. 40 - 85 F.
   e. Process Humidity: near 100%.

3. Performance:
   a. Operating Range: 0 - 30 feet.
   b. Minimum Range: 5.5'
   c. Maximum Range: 30'
   d. Range Accuracy: +/- 0.1".

4. Element:
   a. Mounting Type: Process connection threaded 1 1/2", see Drawing P501 for additional mounting detail.
   b. Antenna Type: Parabolic (or other means to narrow beam angle).
   c. Operating frequency: 6GHz < Freq. < 30 GHz.
   d. Beam Angle: < = 4 degrees.

5. Transmitter:
   a. Type of physical installation: integral mount to element.
   b. Required Features:
      1) Measured results: Distance between top of tank and liquid level.
      2) Local indicator and operator interface.
         (a) At least a one line LCD display with keypad capable of programming, diagnostic evaluation, and level display (in engineering units) without the requirement of an additional hand held programming device.
         (b) Communications protocol: Bluetooth wireless.
      3) Transmitter/analyzer algorithms shall have the capabilities to:
         (a) Calculate and transmit flow.
         (b) Automatic false echo reducing algorithms.
         (c) Manual capability to adapt gain and other signal processing parameters.
      4) Transmit a linear signal proportional to the measured distance -- see "Electrical".
      5) Stored operating parameters and configuration data shall not be lost on interruption of power source.

6. Ambient Environment:
   (a) Location: Multiple installations and conditions; see schedule.
   (b) Mounting: Integral mounting to element.
   (c) Temperature: perform as specified from 40 to 122 F.
   (d) Humidity: 5 to 95% non-condensing.
   (e) Enclosure: IP66/68 / NEMA 4X/6P

7) Electrical
   (a) Compliance/Certification/Listing: FM for Class 1, Div. 1 locations.
   (b) Power Source: Loop-Powered, 50/60 Hz, 120 VA max.
   (c) Discrete Outputs: none required.
   (d) Analog output: passive, 4-20mA, capable of driving at least 500 ohms.

6. Acceptable Manufacturers
   a. Endress + Hauser series FMR62
   b. VEGA PULS 6X
   c. Engineer approved equivalent.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install units in accordance with manufacturer's recommendations and as indicated on drawings.
B. Units shall be installed and programmed by well qualified and experienced craftsmen and engineers/technicians.
C. Locations, orientations, and quantities as indicated on drawings.
D. Units shall be properly interfaced with the input and output devices.
E. Electrical and control wiring, cabling, conduits, connections shall be according to Division 26 and this Section.
F. Include all required-related items for a complete installation.
G. Contractor shall be responsible for compatibility of manufacturer’s shop coating and final finish.
H. Support and anchor all units as per the manufacturer’s recommendations and as indicated on drawings.

END OF SECTION 25 3100
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INSTRUMENTATION AND CONTROL SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Instrumentation Schedule.
B. Control Panel Schedule.

PART 2 PRODUCTS

2.01 INSTRUMENTATION SCHEDULE

A. Radar Level Sensor/Transmitter: with SS engraved tag (Level Transmitter - LT-BST-###):
   1. 70-BSL-LT-01 - Range 0-20 Ft; Blended Sludge Tank 1 Level, See Process Details for Mounting Requirements.
   2. 70-BSL-LT-02 - Range 0-20 Ft; Blended Sludge Tank 2 Level, See Process Details for Mounting Requirements.
   3. 70-BSL-LT-03 - Range 0-20 Ft; Blended Sludge Tank 3 Level, See Process Details for Mounting Requirements.
   4. 70-HW-LT-01 - Range 0-20 Ft; Waste to Digester Tank Level, See Process Details for Mounting Requirements.
   5. 70-HW-LT-02 - Range 0-20 Ft; Waste to Digester Tank Redundant Level, See Process Details for Mounting Requirements.
   6. Shelf Spare Unit - preconfigured.

2.02 CONTROL PANEL SCHEDULE

A. Abbreviations:
   1. CP: Control Panel - Existing.
   2. LCP: Local Control Panel.
   3. IJB: Instrument Junction Box - Existing.
   4. (G): Green.
   5. (R): Red.
   7. (W): White

B. 70-BSL-LCP-01
   1. Description/Location: Blended Sludge Mixer 1 Local Control Station; Mixer Area
   2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
   3. Element Location: Front.
      a. Mixer Running Pilot Light (G)
      b. Mixer Alarm Pilot Light (A)
      c. Mixer Stopped Pilot Light (R)
      d. Mixer Required Pilot Light (W)
      e. Mixer Hand-Off-Auto (HOA) Selector Switch
      f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
   4. Element Location: Internal.
      a. None

C. 70-BSL-LCP-02
   1. Description/Location: Blended Sludge Mixer 2 Local Control Station; Mixer Area
   2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
   3. Element Location: Front.
      a. Mixer Running Pilot Light (G)
      b. Mixer Alarm Pilot Light (A)
      c. Mixer Stopped Pilot Light (R)
      d. Mixer Required Pilot Light (W)
e. Mixer Hand-Off-Auto (HOA) Selector Switch  
f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS  
4. Element Location: Internal.  
a. None  

D. 70-BSL-LCP-03  
1. Description/Location: Blended Sludge Mixer 3 Local Control Station; Mixer Area  
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.  
3. Element Location: Front.  
a. Mixer Running Pilot Light (G)  
b. Mixer Alarm Pilot Light (A)  
c. Mixer Stopped Pilot Light (R)  
d. Mixer Required Pilot Light (W)  
e. Mixer Hand-Off-Auto (HOA) Selector Switch  
f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS  
4. Element Location: Internal.  
a. None  

E. 70-BSL-LCP-04  
1. Description/Location: Blended Sludge Mixer 4 Local Control Station; Mixer Area  
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.  
3. Element Location: Front.  
a. Mixer Running Pilot Light (G)  
b. Mixer Alarm Pilot Light (A)  
c. Mixer Stopped Pilot Light (R)  
d. Mixer Required Pilot Light (W)  
e. Mixer Hand-Off-Auto (HOA) Selector Switch  
f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS  
4. Element Location: Internal.  
a. None  

F. 70-BSL-LCP-05  
1. Description/Location: Blended Sludge Mixer 5 Local Control Station; Mixer Area  
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.  
3. Element Location: Front.  
a. Mixer Running Pilot Light (G)  
b. Mixer Alarm Pilot Light (A)  
c. Mixer Stopped Pilot Light (R)  
d. Mixer Required Pilot Light (W)  
e. Mixer Hand-Off-Auto (HOA) Selector Switch  
f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS  
4. Element Location: Internal.  
a. None  

G. 70-BSL-LCP-06  
1. Description/Location: Blended Sludge Mixer 6 Local Control Station; Mixer Area  
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.  
3. Element Location: Front.  
a. Mixer Running Pilot Light (G)  
b. Mixer Alarm Pilot Light (A)  
c. Mixer Stopped Pilot Light (R)  
d. Mixer Required Pilot Light (W)  
e. Mixer Hand-Off-Auto (HOA) Selector Switch
f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS

4. Element Location: Internal.
   a. None

H. 70-BSL-LCP-07
1. Description/Location: Blended Sludge Mixer 7 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

I. 70-BSL-LCP-08
1. Description/Location: Blended Sludge Mixer 8 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

J. 70-BSL-LCP-09
1. Description/Location: Blended Sludge Mixer 9 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

K. 70-BSL-LCP-10
1. Description/Location: Blended Sludge Mixer 10 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

L. 70-BSL-LCP-11
1. Description/Location: Blended Sludge Mixer 11 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

M. 70-BSL-LCP-12
1. Description/Location: Blended Sludge Mixer 12 Local Control Station; Mixer Area
2. Panel Enclosure: NEMA 4XSS, wall mount (size as required-minimum 9.5"H x 6.25"W x 3.0"D) - Saginaw SCE-6PBSS or approved equal.
3. Element Location: Front.
   a. Mixer Running Pilot Light (G)
   b. Mixer Alarm Pilot Light (A)
   c. Mixer Stopped Pilot Light (R)
   d. Mixer Required Pilot Light (W)
   e. Mixer Hand-Off-Auto (HOA) Selector Switch
   f. Plug unused hole with NEMA 4X SS Hole Plug - Saginaw SCE-ASPB-SS
4. Element Location: Internal.
   a. None

N. Instrument Junction Box - Existing
1. Description/Location: Blended Sludge Tank Level Transmitter Junction Box; Sludge Processing Building
2. Panel Enclosure: NEMA 4X - Existing
3. Element Location: Front.
   a. None.
   a. Remove and dispose of existing DC Power Supply and terminals.
   b. Panel Surge Protection.
   c. DC Power Supply.
   d. Breakers, Fuses, Terminals, and Misc. as required.

O. Level Monitoring Control Panel - Existing
1. Description/Location: Level Monitoring Panel; Waste to Digester Tank
2. Panel Enclosure: NEMA 4X - Existing
   a. Re-use Waste to Digester level meter for powering replacement radar level transmitter and transmitting signal to PLC.
   b. Add Waste to Digester level meter for powering redundant radar level transmitter and transmitting signal to PLC. Existing Level Meter: Red Lion P/N - PAXP0000-PAXCDLI0
   c. Level meter name plate to match existing name plates.
   a. Breakers, Fuses, Terminals, and Misc. as required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Include all required-related items for a complete installation.
END OF SECTION 25 9110
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SECTION 25 9120
MEASUREMENT AND CONTROL COMMISSIONING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Start up, shake down, and training for instrumentation.

1.02 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Submittal shall contain:
   1. Identification of the respective responsibilities of each party to the project, including what is
      provided by the system manufacturer, what is to be subcontracted.
   2. Description of the major user related features and operating characteristics of the proposed
      system.
   3. Description of all master site hardware and software, including examples of digital displays,
      and how the operator will interface with the system to achieve each specified function.
   4. Describe the training program. An outline shall be provided that covers the basic software
      and hardware training, operator training, system maintenance training, and programming
      training. Identify the course content and the time spent on each subject area.
   5. Describe the startup implementation plan, participants' responsibilities and a schedule of
      events.
   6. All significant equipment to be supplied shall be listed, followed by descriptive data sheets.
      The equipment list shall include each component name, manufacturer, model number, a
      description of the operation, quantity supplied, and any special setup and operation and
      maintenance characteristics.
   7. Drawings of equipment to be supplied shall include as a minimum, overall dimensions and
      details for each unit, including installation arrangements, door mounted operator devices,
      and instruments. Wiring diagrams of all system components, including field device
      connections, shall be included and specific installation wiring responsibilities identified.
C. Operations and maintenance manuals.

1.03 START-UP SERVICE REPRESENTATIVE
A. Provide qualified service representative to perform functions described in Section 01 4000 and
   the following.
B. Provide for equipment installation check, calibrations, control adjustments, startups, and other
   services in the field by qualified service representative to produce complete working installation
   in compliance with drawings and specifications, satisfactory to Owner and Engineer.
C. This field service is to cover both the separate mounted instrumentation involved in the system
   and the various control panels and components.
D. Coordinate with General Contractor, Sub-Contractors and Equipment Suppliers to provide start-
   up services in concert with other equipment in the project.
E. In addition to the field services, arrange for Owner training to be performed by the Manufacturer
   in the use and maintenance of all instrumentation and control system equipment supplied. Refer
   to scheduled training requirements.
F. Provide complete start-up services until all systems are fully functional
G. Provide training program in sufficient depth that Owner can maintain and extend
   hardware/software functionality. Minimal courses shall include:
   1. Detailed system operating procedures:
      a. Location: On-site.
      b. Timing: During commissioning.
      c. Length: 1 hour per session (3 sessions). Each training topic shall be included in all
         three sessions.
H. Training Shall not occur until all O&Ms, submittals, manufacturer's certification of proper
   installation and any other associated paperwork and startup items have been completed to
satisfaction of Owner and Engineer.

1.04 ACCEPTANCE FOR OPERATION

A. Owner will accept equipment and systems for operation when construction has been substantially completed by Contractor. "Acceptance for Operation" shall mean Owner will assume operational and routine maintenance duties. "Acceptance for Operation" does not relieve Contractor from responsibilities related to defective materials and workmanship; neither does it constitute final acceptance of materials and equipment. See contract completion requirements.

B. After Owner has accepted system for operation, Contractor shall continue to perform the following as requested and scheduled by Owner at no additional cost to Owner:
   1. Troubleshooting, adjustments, and repairs until system operation and performance is acceptable.
   2. Craft labor as required.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 START-UP

A. No form of energy shall be turned on to any part of the instrumentation and control system prior to the receipt, by the Engineer, of written approval of the installation of equipment by the manufacturer.

3.02 TRAINING SCHEDULE

A. Remote Device (e.g. LT): One hour on-site for each type of instrument per session.

B. See paragraph 1.03 G of this Section for additional Training requirements.

C. Training Sessions: 3 separate training sessions on two different days to accommodate all operator shifts (i.e. Day 1 in the afternoon and Day 2 in the morning and afternoon). Each training topic shall be included in three sessions.

D. All training shall be scheduled with Owner a minimum of 2 weeks in advance of training.

END OF SECTION 25 9120
SECTION 26 0500
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1  GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26.
B. The general provisions of this Section apply to the other Division 26 sections.
C. The work shall include the furnishing of systems, equipment and materials specified in this Division and as called for on the Drawings, to include: supervision, operation, methods and labor for the fabrication, installation, startup and tests for the complete electrical installation.
D. Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as connectors, fittings, access panels, pullboxes, etc. are not necessarily shown. Where such items are required for proper installation of the Work, such items shall be included.
E. Equipment specifications may not deal individually with minute items required such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for.
F. Where noted on the Drawings or where called for in other sections of the Specifications the Contractor shall install equipment under this Contract and shall make required electrical connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

1.02 WORK BY OTHERS

A. The Owner may award contracts which will run concurrent to the Work.  
1. See notes on plans for extent of Division 26 participation.

1.03 OWNER FURNISHED PRODUCTS

A. Products furnished to the site and paid for by Owner shall be as noted on Drawings.

1.04 CONTINUITY OF SERVICE

A. Coordinate Work to accommodate Owner’s occupancy requirements during the construction period. Refer to Section 01 1000 - Summary for additional requirements.

1.05 ACTIVE SERVICES

A. Existing active services: water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities having jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Submittal data for electrical equipment shall consist of shop drawings and/or catalog cuts showing technical data necessary to evaluate the material or equipment, to include power requirements (wattage, voltage, amperage, power factor, etc.) dimensions, wiring diagrams, performance curves, ratings, (electrical, environmental, etc.), control sequences and other descriptive data necessary to describe fully the item proposed and its operating characteristics. Shop drawings shall be submitted for equipment and materials as directed in individual sections.
C. Proposed Products List: Include Products specified in all Sections.
D. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
E. Mark dimensions and values in units to match those specified.

F. The Engineer will review shop drawings to aid in interpreting the Contract Documents, and will in so doing assume that the shop drawings conform to all specified requirements set forth in the Contract Documents. The review of the shop drawing by the Engineer does not relieve the Contractor of the responsibility of complying with all elements of the Contract Documents.

1.07 REGULATORY REQUIREMENTS

A. Imposed Standards/Regulations:

1. General: Applicable provisions of the following codes and standards are hereby imposed on a general basis for the electrical work in addition to specific applications specified by individual work sections of the Specifications.
   a. Underwriters Laboratories (UL).
   c. NFPA Standards and Pamphlets.
   d. Local and State Electrical, Mechanical and Building Codes as they apply.
   e. American Gas Association (AGA).
   f. AWS Standards for Welding.

2. Every installation shall also comply with applicable Divisions and Sections of this Specification. If changes are required to attain compliance, the Contractor shall submit the proposed changes to the Engineer for review and approval. If approval for the change is obtained, revised submittal data shall be provided for review.

3. Installations must be safe in every respect, and must not create any condition which will be harmful to building occupants, operating personnel, installation personnel, testing personnel, construction workers, and general public. If Contractor believes that the installation will not be safe for all parties, the Contractor shall so report in writing to the Engineer, stating the issues and conditions and possible remedies, before any equipment is purchased or installed.

4. The manufacturer of each type of equipment, used by itself or as a part of any system, shall carefully check capacities, arrangements, and methods shown or specified (including space requirements, servicing requirements, ambient air temperatures, etc.) for installation of the equipment, and all connections to other system or to parts of same system to assure that when used, connected, interconnected, piped, wired, or controlled as specified, the equipment can be properly serviced. If the manufacturer has any reservations in this regard, the manufacturer shall state such reservations and any suggested changes to the Engineer as a part of the shop drawing submission.

5. Engineer will work out required changes and adjustments in Contract Prices where such adjustments are warranted. No adjustments in Contract Price will be allowed for additions required by applicable code, ordinance, statute, utility regulation, or labor regulation. It is the obligation of the Contractor to include such items in the original Bid. Changes in equipment shall be incorporated in shop drawings. If Contractor fails to call such reservations or suggestions to Engineer's attention, in writing, before any work is done or equipment is purchased, it will be assumed that the Contractor accepts responsibility for providing a completely safe and completely coordinated installation. If at a later date changes become necessary to assure a completely safe and coordinated installation, they shall be made, as approved by Engineer, without increase in Contract Price.

B. Permits and Tests, Electrical Work: Unless otherwise noted in the detailed contractual description preceding these technical specifications, the Contractor shall secure all permits and pay all fees required in connection with this installation and shall be responsible for securing such inspections as are required by the authorities with jurisdiction over the site. Submit a record copy to the Owner and the Engineer of electrical work notices, permits, licenses, inspection or test reports, and similar items obtained in response to governing and imposed regulations and standards.

1.08 PROJECT CONDITIONS

A. Inspect site prior to bidding to be thoroughly familiar with existing conditions.

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

D. All Contractors shall familiarize themselves with the site and with any conditions of the site and/or existing buildings which might present unusual aspects to the work involved. Contractor shall verify all aspects of electrical work, insofar as is possible, check routes of conduit indicated, verifying clearances and other obstacles which might influence the construction proposed. No extras can be allowed on work occasioned by the Contractor's failure to make this inspection.

1.09 SEQUENCING AND SCHEDULING

A. Install work to accommodate Owner's occupancy requirements during construction period and coordinate electrical schedule and operations with Owner.

B. Construct Work in sequence under provisions of Division 1 - General Requirements and other Sections as applicable.

C. Completion of Electrical Work shall be coordinated with other trades and contractors to expedite completion of the Project.

D. The Contractor shall coordinate the placing of openings in the structures as required for the installation of the Electrical Work.

E. It will be the Contractor's responsibility to examine the Drawings and Specifications, to take measurements where required, to verify dimensions for correct placement of equipment and to progress the Contract as expeditiously as possible, so that the progress of the work is orderly and does not cause unnecessary cutting and patching of the structure. The Contractor shall be pecuniarily responsible for the cutting and patching of the structure occasioned by failure to install sleeves, grilles or other items required by the Electrical Work at the proper time for the normal installation of such items.

F. The Contractor shall provide cutting and patching and patch painting of the structure, as required for the installation of the Work, and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

G. The determination of quantities of material and equipment required shall be made by the Contractor from the Contract Documents. Schedules on the Drawings and in the Specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

1.10 OPENINGS, CUTTING, AND PATCHING

A. The Contractor shall coordinate the placing of openings in structures, as required, for the installation of the Electrical Work.

B. The Contractor shall coordinate the accurate locations and sizes for required openings, and shall have the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to the Contractor's failure to inspect the work, then the Contractor shall make arrangements for the patching required to properly close the openings, to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

C. When cutting and patching of the structure is made necessary due to the Contractor's failure to install conduit wiring or equipment on schedule, or due to the Contractor's failure to furnish, on schedule, the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements for the cutting and patching and the Contractor shall pay any additional cost incurred in the correction.

D. The Contractor shall provide cutting, patching and patch painting as required for the installation of Work in existing structures, and shall furnish lintels and supports as required for openings.

E. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and
surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.11 FUTURE WORK
A. Provide for future work as noted on plans.

1.12 ALLOWANCES
A. Cash Allowance: Refer to other Sections and Plans for allowance sum applicable to Work (if any).
B. Allowance includes purchase, delivery and installation and is to be included as part of the Contract Price.

1.13 ALTERNATES
A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
B. Coordinate related work and modify surrounding work as required.
C. Schedule of Alternates:
   1. See plans, other Divisions and Bid Form for alternates.

1.14 CONCRETE WORK
A. The Contractor shall coordinate size and location of concrete bases and pads for electrical equipment with the required trades and with the Utility.
B. The Contractor shall furnish equipment anchor bolts and shall be responsible for their proper installation and accurate location.

1.15 WIRING FOR ELECTRICAL EQUIPMENT
A. The Contractor will provide power services for motors and equipment furnished by the Mechanical Contractor to include safety disconnect switches and final connections.
B. The Contractor will be responsible for power wiring, internal wiring, alarm wiring, control wiring or interlock wiring of all equipment installed or modified under this Contract.
C. This Contractor will furnish motor starters for motors furnished by the Mechanical Contractor, except where other Sections call for starters to be furnished by the Mechanical Contractor.
D. The Contractor shall review the Drawings and shall call to the attention of the Engineer, prior to bidding, omissions of electrical services required for this equipment.

1.16 PROTECTION
A. Special care shall be taken for the protection of equipment furnished by the Contractor. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the Project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
B. Protection of equipment during the plastering and painting of the building shall be the responsibility of the Contractor performing that work, but this shall not relieve the Contractor of the responsibility of checking to assure that adequate protection is being provided.
C. Where the installation or connection of equipment requires the Contractor to work in areas previously finished, the Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. The Contractor shall repair and refinish such areas which were damaged due to work performed by the Contractor.
D. When heavy materials must be placed upon or transported over the roof deck, sheeting shall be placed to distribute weight and support such materials.

1.17 FINISHING
A. Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.
B. Perform cleaning required by Division 1 applicable to this Division of the Work. Cleaning shall include removing debris and dirt from panels, pull boxes, junction boxes, and other enclosures.
C. Operation and Maintenance Manuals: Prepare and submit Operation and Maintenance manuals as described in Division 1 and related sections in Division 26.

1.18 TEST AND DEMONSTRATIONS
A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
B. Prior to acceptance of the electrical installation, the Contractor shall demonstrate to the Owner or designated representatives all essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems.
C. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instructions and shall arrange to have the manufacturer's representatives for the system present to assist with the demonstrations. The Owner and Contractor shall each sign a certification stating that the training has been performed and the Owner accepts same.

1.19 PAINTING AND IDENTIFICATION
A. Painting of electrical enclosures (switch/outlet boxes, starters, disconnects, control cabinets and panelboards) shall be touch-up only of factory finish or finish specified elsewhere.
B. Conduit and raceway systems shall be unpainted unless specifically noted. If painting of conduit and raceway systems is required, coat with paint type and color to match background mounting surface.
C. Identify panels, switchgear, starters, switches, valves and dampers with engraved nameplates.
D. Provide typed panel and switchboard schedules.
E. Provide plastic "Buried Electrical" warning tape in trench above all underground circuit runs. Place approximately 18 inches below finished grade.

1.20 PRODUCT QUALITY, PERFORMANCE, AND SUBSTITUTIONS
A. All materials shall be the standard product of a reputable manufacturer regularly engaged in the manufacture of the specific product, and where more than one unit is required of the item, all shall be of the same manufacturer.
B. Proposals as submitted shall be based on the products specifically named in the specifications.
C. If specific products of more than one manufacturer are specified, the choice of these shall be made optional with the Contractor.
D. All materials are subject to approval by the Engineer both before and after incorporation in the building.
E. Should suppliers of materials not specified wish to bid their material as a base bid equal, they shall secure the written approval of the Engineer that their product is acceptable as an equal to that specified at least ten (10) days in advance of the bid date to have their products covered in an Addendum prior to opening of bids.
F. The Engineer reserves the right to refuse approval on equipment which does not meet the specification. Any materials not conforming to the specification may be ordered removed any time during the course of construction, and the Contractor shall replace such items, when notified, at the Contractor's expense. The Engineer further reserves the right to reject equipment for which the availability of maintenance service and replacement parts is questionable.
G. All materials and equipment shall be new. Second-hand, used, or salvaged equipment will not be allowed unless specifically noted.
H. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.
I. The Engineer reserves the right to determine space priority of the equipment in the event of interference between the piping and equipment of the various installations. Conflicts between the Drawings and Specifications, or between requirements set forth for the various trades shall be called to the attention of the Engineer. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that the Contractor has submitted the bid in
1.21 EXCAVATING, TRENCHING AND BACKFILLING

A. The Contractor shall do excavating necessary for underground electrical ducts, wiring, manholes, conduit, etc., and shall backfill such trenches and excavations after equipment has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe.

B. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than necessary.

C. Immediately after testing and/or inspection, the trench shall be carefully backfilled. Place backfill into trench so the impact on installed pipe is minimized. Backfill and compact to specifications described in Division 2 for utility trenching.

1.22 COORDINATION

A. Where the Contract Documents state that equipment shall be “furnished”, “installed”, or “provided”, it shall be understood to mean the Contractor shall furnish and install completely unless otherwise noted.

1.23 EXISTING SERVICE

A. If existing services are encountered in the Work, protect, brace, and support existing active sewers, gas, electric, or other services where required for the proper execution of the Work. If existing active services are encountered that require relocation, make request to proper authorities for determination of procedure. Do not prevent or disturb operation of active services that are to remain.

1.24 TEMPORARY SHUTDOWNS OR ABANDONED SERVICES

A. Where the Work makes temporary shutdowns or need to abandon unavoidable, Contractor shall consult with the Owner as to times and procedures for such shutdowns. Where existing services are to be abandoned, wiring shall be removed and conduit shall be properly capped in conformance with requirements of the Utility.

1.25 SITE

A. The site shall be kept orderly and clean at all times during the construction and the storing of materials shall be in accordance with the requirements of the Owner in areas designated for that purpose. At the conclusion of the construction, the site shall be cleaned thoroughly of all rubble, debris and unused materials and shall be left in good order. All tunnels, chases or closed off spaces shall be cleaned of all waste materials, wood frame members, etc. used in construction.

1.26 NOISE AND VIBRATION

A. Electrical equipment shall operate without objectionable noise or vibration as determined by the Engineer. If such objectionable noise or vibration should be produced and transmitted to occupied portions of the building by apparatus, conduit, ducts or other parts of the electrical work, the Contractor shall make necessary changes and additions, as approved by the Engineer.

1.27 EQUIPMENT INSTALLATION

A. Erect equipment in neat and workmanlike manner, align, level and adjust for satisfactory operation, install so that connecting and disconnecting parts can be made readily and so that all parts are easily accessible for inspection, operation and maintenance.

1.28 APPLICATIONS

A. Where applications are required for the procuring of utility service to the building, the Contractor shall see that such application is properly filed with the Utility and that all information required for such an application is presented to the extent and in the form required by the Utility Company.

1.29 RECORD UTILITIES DRAWINGS

A. Contractor shall prepare and submit to Engineer drawings showing the exact location of all installed underground electrical and conduit runs and any existing underground utilities.
encountered during installation. The drawings shall give accurate locations (referenced to visible above-grade objects) and dimensions of all such equipment for future use by the Owner. These drawings shall be submitted to the Engineer as soon as practicable after such runs have been installed.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION 26 0500
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SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Electrical demolition.

PART 2  PRODUCTS
2.01  MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections or as required to complete work.

PART 3  EXECUTION
3.01  EXAMINATION
   A. Verify field measurements and circuiting arrangements are as indicated.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition drawings are based on casual field observation and existing record documents.
   D. Report discrepancies to Engineer before disturbing existing installation.
   E. Beginning of demolition means installer accepts existing conditions.

3.02  PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   B. Coordinate utility service outages with utility company.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
   D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
      1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
      2. Make temporary connections to maintain service in areas adjacent to work area.
   E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
      1. Notify Owner before partially or completely disabling system.
      2. Make notifications at least 24 hours in advance.
      3. Make temporary connections to maintain service in areas adjacent to work area.
   F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
      1. Notify Owner at least 24 hours before partially or completely disabling system.
      2. Notify telephone utility company at least 24 hours before partially or completely disabling system.

3.03  DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
   A. Remove, relocate, and extend existing installations to accommodate new construction.
   B. Remove abandoned wiring to source of supply.
   C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
   D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
G. Repair adjacent construction and finishes damaged during demolition and extension work.
H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR
A. Clean and repair existing materials and equipment that remain or that are to be reused.
B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION 26 0505
SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Single conductor building wire.
B. Wire and cable for 600 volts and less.
C. Wiring connectors.
D. Electrical tape.
E. Heat shrink tubing.
F. Wire pulling lubricant.

1.02 REFERENCE STANDARDS
A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.
F. NECA 1 - Standard for Good Workmanship in Electrical Construction.
H. NFPA 70 - National Electrical Code.
I. UL 44 - Thermoset-Insulated Wires and Cables.
J. UL 83 - Thermoplastic-Insulated Wires and Cables.
K. UL 486A-486B - Wire Connectors.
L. UL 486C - Splicing Wire Connectors.
M. UL 486D - Sealed Wire Connector Systems.
N. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide for each cable assembly type.
C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS
   A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.
   B. Perform Work in accordance with NECA Standard of Installation.
   C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect, and handle Products to site.
   B. Accept wires and cables on site. Inspect for damage.
   C. Protect wires and cables from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.09 WARRANTY
   A. Full warranty against defects in materials and workmanship for one (1) year after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 MANUFACTURER
   A. Alan Wire Company.
   B. Belden, Inc.
   C. Cablec.
   D. Carroll.
   E. Southwire Company.
   F. Triangle.
   G. Engineer approved equivalent.
   H. All conductors/circuits shall be copper conductor. Use of aluminum conductors shall not be allowed unless specifically noted.
   I. All circuits shall be installed as building wire, control wire, or signal cable in raceway unless specifically noted or indicated on the Drawings.
   J. Use conductor not smaller than #12 AWG for power and lighting circuits.
   K. Use conductor not smaller than #14 AWG for control circuits.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS
   A. Provide products that comply with requirements of NFPA 70.
   B. Provide products listed, classified, and labeled as suitable for the purpose intended.
   C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
   D. Comply with NEMA WC 70.
   E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
   F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
   2. Control Circuits: 14 AWG.

I. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.
      e. For control circuits, comply with manufacturer’s recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Installed Underground: Type XHHW-2 or THHN/THWN-2.
      b. Between VFD outputs and motors: Type XHHW-2, unless specifically indicated otherwise.

E. All wire routed through underground raceway shall be listed for wet location.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 10 AWG and smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 8 AWG and larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.05 WIRING ACCESSORIES

A. Electrical Tape:
   1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   2. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

2.06 CONTROL AND SIGNAL CABLE

A. Cable for Discrete Control Signals:
   1. Single conductor, #14 AWG stranded copper, type THHN/THWN insulation.

B. Signal Cable for Analog Control Signals:
   1. One twisted shielded pair #18 AWG, 300V - Belden 8760 or equal.
   2. One twisted shielded triad (3-conductors), #18 AWG, 300V - Belden 8770 or equal.

2.07 CORDS

A. Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for extra-hard usage in damp locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as indicated.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify conduit systems are ready to accept cables.

B. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.
C. Perform work in accordance with NECA 1 (general workmanship).
D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
G. Install conductors with a minimum of 6 inches of slack at each outlet.
H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
J. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
   2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
L. Insulate ends of spare conductors using vinyl insulating electrical tape.
M. Identify conductors and cables in accordance with Section 26 0553.
N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
P. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
Q. All interconnecting circuit wires or cables (power and control) shall be tagged with an appropriate numbering system that assigns a unique identification to the wire or cable that is compatible with the tagging system of the connected equipment. Tags shall be applied at all junctions and terminations of each wire or cable.
R. Install a waterproof sealant (such as silicone rubber) in conduits connected to control valves, instrumentation, and other electrical power and control devices mounted directly to water piping. Inject sealant near end of flexible conduit connected to device. Install sealant after all power and control conductors have been installed and operation of equipment has been verified.
S. Route wire and cable as required to meet project conditions.
T. Pull all conductors into raceway at same time.
U. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
V. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
W. Neatly train and lace wiring inside boxes, equipment, and panelboards.
X. Clean conductor surfaces before installing lugs and connectors.
Y. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
Z. Terminate spare conductors with electrical tape and label as such.

3.04 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
C. Perform field inspection and testing in accordance with Section 01 4000.
D. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
E. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 0519
PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Grounding and bonding requirements.
   B. Conductors for grounding and bonding.
   C. Connectors for grounding and bonding.
   D. Wire, components, and miscellaneous equipment in supplying and installing electrical grounding systems.

1.02 RELATED REQUIREMENTS
   A. Section 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
   C. NFPA 70 - National Electrical Code.
   D. UL 467 - Grounding and Bonding Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittals procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Comply with TIA/EIA-607 for telecommunications grounding.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 WARRANTY
   A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

PART 2  PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS
   A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
   C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   D. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 GROUNDING AND BONDING COMPONENTS
A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26.0526:
   1. Use insulated copper conductors unless otherwise indicated.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
   a. Exceptions:
      1) Use exothermic welded connections for connections to metal building frame.

2.03 CONDUCTORS/WIRE
A. Material: Copper.
B. Equipment grounding conductors:
   1. Stranded, insulated.

C. Size conductors as indicated on the Drawings. If no size is indicated, size conductors to meet NFPA 70 requirements.

2.04 CONNECTORS AND ACCESSORIES
A. Compression Crimp Connectors: Copper.
B. Mechanical Connectors: Bronze.
C. Exothermic Connectors: Exothermic pre-measured charges and molds without pits or cracks as required for various configurations using electrical ignition system.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify that field measurements are as indicated.
C. Verify that conditions are satisfactory for installation prior to starting work.
D. Verify existing conditions prior to beginning work.
E. Verify final length and location of ground conductors.
3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
D. Identify grounding and bonding system components in accordance with Section 26 0553.
E. Install Products in accordance with manufacturer's instructions.
F. Provide bonding to meet requirements described in Quality Assurance.
G. Equipment Grounding Conductor: Provide an equipment grounding conductor with each feeder and branch circuit regardless of raceway type. Terminate each end on suitable lug, bus, or bushing.
H. Concealed connections such as those underground or buried inside inaccessible wall or ceiling spaces shall be compression crimp or exothermic type. Mechanical connections shall be for exposed or readily accessible connections only.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
C. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
D. Perform inspections and tests listed in NETA ATS, Section 7.13.
E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 26 0526
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SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.
B. Conduit and equipment supports.
C. Anchors and fasteners.

1.02 REFERENCE STANDARDS
A. MFMA-4 - Metal Framing Standards Publication.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
C. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide manufacturer’s catalog data for fastening systems.
C. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 DESCRIPTION
A. Description: Steel channel, fittings, and anchors used to support various electrical devices and equipment racks.

1.06 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with applicable building code.
C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Materials and components shall be inspected for damage and physical defects.
B. Materials and components shall be stored in accordance with manufacturer’s recommendations.

1.08 WARRANTY
A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.
PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
      a. Indoor Dry Locations: Use 304 stainless steel unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use 304 stainless steel unless otherwise indicated.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel, malleable iron, or aluminum depending on conduit type.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   2. Channel Material:
      a. Indoor Dry Locations: Use 304 stainless steel.
      b. Outdoor, Corrosive, and Damp or Wet Indoor Locations: Use 304 stainless steel.

E. Hanger Rods: 304 stainless steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood: Use wood screws.

2.02 MANUFACTURERS

A. Superstrut.
D. Unistrut.
E. B-Line.
F. Engineer approved equivalent.
2.03 MATERIALS
A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type as indicated on the Drawings, adequate to carry the loads of equipment and conduit, including weight of wire in conduit. Provide stainless steel materials in wet, damp, and corrosive areas.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. In wet and damp locations use stainless steel channel supports to stand cabinets, conduits, and panelboards ¼” off wall.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3-1/2 high concrete pad constructed in accordance with Section 03 3000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
H. Secure fasteners according to manufacturer's recommended torque settings.
I. Remove temporary supports.
J. Install products in accordance with manufacturer's instructions.
K. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
L. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
M. Fabricate supports from structural steel or steel channel. Rigidly weld support members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
N. Install surface-mounted cabinets and panelboards with minimum of four anchors.

3.03 FIELD QUALITY ASSURANCE
A. Verify all supports are securely anchored and fastened.
B. Verify all supports are level and square.

END OF SECTION 26 0529
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SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Aluminum rigid metal conduit (RMC).
B. Flexible metal conduit (FMC).
C. Liquidtight flexible metal conduit (LFMC).
D. Rigid polyvinyl chloride (PVC) conduit.
E. Conduit fittings.
F. Accessories.

1.02  RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0533.16 - Boxes for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS
A. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).
B. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction.
D. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit.
E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).
F. NFPA 70 - National Electrical Code.
G. UL 1 - Flexible Metal Conduit.
H. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
I. UL 514B - Conduit, Tubing, and Cable Fittings.
J. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
K. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.

1.04  ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.
1.05 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittals procedures.
B. Product Data: Provide for fittings and conduit.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
B. Accept conduit on site. Inspect for damage.
C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.08 WARRANTY
A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 CONDUIT APPLICATIONS
A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use aluminum rigid metal conduit.
C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
   3. Within Concrete Walls Above Ground: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to aluminum rigid metal conduit after emerging from concrete.
E. Interior, Damp or Wet Locations: Use aluminum rigid metal conduit.
F. Exposed, Interior, Not Subject to Physical Damage: Use aluminum rigid metal conduit.
G. Exposed, Interior, Subject to Physical Damage: Use aluminum rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
I. Corrosive Locations Above Ground: Use aluminum rigid metal conduit.
J. Hazardous (Classified) Locations: Use aluminum rigid metal conduit.
K. Connections to Vibrating Equipment:
   1. Dry Locations: Use liquidtight flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Class I Division 1 Locations: Use listed stainless steel flexible fittings.

4. Maximum Length: 3 feet unless otherwise indicated.

5. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Underground, Exterior: 1 inch (27 mm) trade size.
   3. Telecommunications Pathways: 1 inch trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. Anamet Inc.
   2. Carol Cable Co.
   4. Engineer approved equivalent.

B. Description: NFPA 70, Type FMC standard wall aluminum or reduced wall aluminum flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

D. Description: Interlocked aluminum construction.

E. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METALLIC AND NONMETALLIC CONDUIT

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Carol Cable.
5. Raco Inc.
6. Engineer approved equivalent.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed aluminum flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or aluminum.

D. Description: Interlocked aluminum construction with PVC jacket.

E. Fittings: NEMA FB 1.

2.06 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
3. Carlon.
5. Endot Ind.
7. Engineer approved equivalent.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.07 ACCESSORIES

A. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

B. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

C. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conduit to verify that it is free from damage.
B. Examine conduit to verify it is free of foreign objects.
C. Verify that field measurements are as indicated.
D. Verify that mounting surfaces are ready to receive conduits.
E. Verify that conditions are satisfactory for installation prior to starting work.
F. Verify routing and termination locations of conduit prior to rough-in.
G. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102. Aluminum conduit shall not be installed in contact with concrete or soil.
D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Process areas.
      b. Electrical rooms.
      c. Mechanical equipment rooms.
      d. Within joists in areas with no ceiling.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
      e. Across windows and building penetrations.
   5. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   9. Maintain minimum clearance of 12 inches between conduits and hot surfaces.
   10. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

G. Connections and Terminations:
   1. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   2. Use suitable adapters where required to transition from one type of conduit to another.
   3. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   5. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
   6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

I. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Secure conduits to prevent floating or movement during pouring of concrete.

J. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

K. Telecommunications Raceways: Install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent between boxes or pull points. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Locate junction boxes in straight conduit runs. Do not install junction boxes where conduit runs change direction. Keep telecommunications raceways at least 5 inches away from light fixtures, transformers, panelboards, and feeders. Keep non-metallic telecommunications raceways at least 24 inches away from electrical equipment, feeders, and services.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings with internal bonding jumpers to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding in accordance with Section 26 0526.

P. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL
   A. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING
   A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION
   A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 0533.13
SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
C. Boxes for hazardous (classified) locations.
D. Underground boxes/enclosures.
E. Wall and ceiling outlet boxes.
F. Pull and junction boxes.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0533.13 - Conduit for Electrical Systems:
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 26 2726 - Wiring Devices

1.03 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
G. NFPA 70 - National Electrical Code.
H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
J. UL 508A - Industrial Control Panels.
K. UL 514A - Metallic Outlet Boxes.
L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, boxes for hazardous (classified) locations, and underground boxes/enclosures.
C. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE
A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.
B. Conform to requirements of NFPA 70.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
D. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer’s instructions.

1.08 WARRANTY
A. Full warranty against defects in materials and workmanship for one (1) year after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 BOXES
A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   2. Use cast aluminum boxes where aluminum rigid metal conduit is used.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs. "Bell" boxes are not acceptable.
9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Minimum Box Size, Unless Otherwise Indicated:
   a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
   b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
   c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
12. Wall Plates: Comply with Section 26 2726.
C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 12, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Include cable supports if any dimension of the box is greater than 48 inches.
      c. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that mounting surfaces are ready to receive boxes.
   C. Verify that conditions are satisfactory for installation prior to starting work.
   D. Examine prints for locations of all outlets.
   E. Verify rooms and walls are ready to accept boxes.
   F. Verify field measurements are as shown on Drawings.
   G. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
   C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
   D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
   10. Locate junction and pull boxes in the following areas, unless otherwise indicated:
       a. Concealed above accessible suspended ceilings.
       b. Within joists in areas with no ceiling.
       c. Electrical rooms.
       d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
P. Provide grounding and bonding in accordance with Section 26 0526.

Q. Identify boxes in accordance with Section 26 0553.

R. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

S. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

T. Maintain headroom and present neat mechanical appearance.

U. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

V. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

W. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

X. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Y. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

Z. Use adjustable steel channel fasteners for hung ceiling outlet box.

AA. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

3.03 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box.

B. Coordinate locations and sizes of required access doors.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

END OF SECTION 26 0533.16
SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Electrical identification requirements.
   B. Identification nameplates and labels.
   C. Wire and cable markers.
   D. Warning signs and labels.

1.02  RELATED REQUIREMENTS
   A. Section 09 9123 - Interior Painting.
   B. Section 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
   C. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

1.03  REFERENCE STANDARDS
   C. NFPA 70 - National Electrical Code.
   D. NFPA 70E - Standard for Electrical Safety in the Workplace.
   E. UL 969 - Marking and Labeling Systems.

1.04  ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
   B. Sequencing:
      1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
      2. Do not install identification products until final surface finishes and painting are complete.

1.05  SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittals procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
   C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.06  QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.07  FIELD CONDITIONS
   A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.
   B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2  PRODUCTS

2.01  IDENTIFICATION REQUIREMENTS
   A. Existing Work: Unless specifically excluded, identify existing elements to remain whose designations are changed as part of the new work.
   B. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Switchboards:
      1) Use identification nameplate to identify load(s) served for each branch device.
   b. Motor Control Centers:
      1) First Line: Full name of equipment.
      3) Third Line: Identify power source and circuit number. Include location when not within sight of equipment.
      4) Use identification nameplate to identify main overcurrent protective device.
      5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   c. Enclosed motor controllers:
      1) First Line: Full name of equipment.
      3) Third Line: Identify power source and circuit number. Include location when not within sight of equipment.
   d. Enclosed switches and circuit breakers:
      1) First Line: Full name of equipment.
      2) Second Line: Identify power source and circuit number. Include location when not within sight of equipment.

2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Motor control centers.
   d. Industrial machinery.

3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

4. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent. Coordinate wording with Owner.

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Boxes:
   1. Use identification labels to identify circuits enclosed.
      a. For exposed boxes, provide identification on inside face of cover.

E. Identification for Devices:
   1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:

2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use stainless steel with black enamel nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Color: White text on black background.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:

   a. Use only for indoor locations.

3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Plastic Nameplates: Minimum Size: 1 inch by 2.5 inches.
2. Identification Labels: 0.5 inch by 2.5 inches.

3. Legend:
   a. Equipment designation or other approved description.

4. Text: All capitalized unless otherwise indicated.

5. Minimum Text Height: 3/8 inch

6. Color:

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: Split sleeve type wire markers.

H. Locations: Each conductor at motor control centers, control panels, panelboard gutters, pull boxes, and junction boxes at each load connection.

I. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on shop drawings.
2.04 WARNING SIGNS AND LABELS
A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION
3.01 PREPARATION
A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Boxes: Outside face of cover.
   8. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

3.03 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
C. Install nameplates and labels parallel to equipment lines.

END OF SECTION 26 0553
SECTION 26 0573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Short-circuit study.
B. Protective device coordination study.
C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.
D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS
A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
B. Section 26 2419 - Motor-Control Centers.
C. Section 26 2813 - Fuses.
D. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS
C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
G. NEMA MG 1 - Motors and Generators.
I. NFPA 70 - National Electrical Code.
J. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.
C. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Engineer.
D. Scheduling:
   1. Arrange access to existing facility for data collection with Owner.
2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Study preparer's qualifications.
C. Field testing agency's qualifications.
D. Study reports, stamped or sealed and signed by study preparer.
E. Field quality control reports.
F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
G. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of both new and directly affected existing portions of electrical distribution system equipment provided in this project including the existing feeder breakers in Switchboard 75-2.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.
         2) Generator as source.
         3) Bus tie breaker open/close positions.
         4) Maintenance settings.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
      d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      e. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available
field-adjustable trip response settings, and features (e.g. zone selective interlocking).
2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
   f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
   g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:
   a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:
   2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
      a. Maximum utility fault currents.
      b. Maximum motor contribution.
      c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
   3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
   1. Comply with applicable portions of IEEE 242 and IEEE 399.
   2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
   3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:
   1. Comply with NFPA 70E.
   2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
      a. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.
      b. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
      c. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 yielding conservative results.
   3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
      a. Maximum and minimum utility fault currents.
      b. Maximum and minimum motor contribution.
      c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
   1. General Requirements:
      a. Identify date of study and study preparer.
      b. Identify study methodology and software product(s) used.
      c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.

2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable):
      1) Partial single-line diagram identifying the portion of the system illustrated.
      2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3) Conductors: Damage curves.
      4) Transformers: Inrash points and damage curves.
      5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
      6) Motors: Full load current, starting curves, and damage curves.
      7) Capacitors: Full load current and damage curves.
   c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
      1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
      2) Include ground fault pickup and delay.
      3) Include fuse ratings.
      4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
   d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.
   d. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in State where project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.
2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

   1. Acceptable Software Products:

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS
   A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
      1. Materials: Comply with Section 26 0553.
      3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
         a. Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
         b. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
         c. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
         d. Include the following information:
            1) Arc flash boundary.
            2) Available incident energy and corresponding working distance.
            3) Site-specific PPE (personnel protective equipment) requirements.
            4) Nominal system voltage.
            5) Limited approach boundary.
            6) Restricted approach boundary.
            7) Equipment identification.
            8) Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting. All on-site work shall be performed by or directly supervised by a Level 3 or Level 4 NETA certified technician.
   C. Inspect and test in accordance with NETA ATS, except Section 4.
   D. Adjust equipment and protective devices for compliance with studies and recommended settings.
   E. Notify Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.
   F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.
3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION 26 0573
SECTION 26 2419
MOTOR-CONTROL CENTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) standard (non-arc-resistant) NEMA motor control centers.
B. Motor control center units:
   1. Feeder units.
   2. Combination magnetic motor starter units.
   3. Distribution equipment units.
C. Overcurrent protective devices for motor control centers and associated units, including overload relays.
D. Motor control accessories:
   1. Auxiliary contacts.
   2. Pilot devices.
   3. Control and timing relays.
   4. Control power transformers.
   5. Control terminal blocks.
E. Motor control centers.
   1. Refer to the Drawings for additional details and component selections pertaining to the motor control centers.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
E. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
C. NECA 402 - Standard for Installing and Maintaining Motor Control Centers.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
F. NEMA ICS 2.3 - Industrial Control and Systems: Instructions for the Handling, Installation, Operation, and Maintenance of MCCs Rated Not More Than 600 Volts.
G. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
H. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
I. NEMA ICS 18 - Motor Control Centers.
J. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
L. NFPA 70 - National Electrical Code.
M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
N. UL 845 - Motor Control Centers.
1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide motor controllers and associated wiring suitable for interface with control devices to be installed.
   4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   6. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
   7. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor control centers, enclosures, units, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, unit arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of motor control centers and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
D. Project Record Documents: Record actual installed locations of motor control centers and final equipment settings.
   1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. Indicating Lights: Two of each different type.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Products: Listed, classified, and labeled as suitable for the purpose intended.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
1.07 WARRANTY
A. Full warranty against defects in materials and workmanship for one (1) year after substantial completion, including all parts, labor, and expenses.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store motor control centers in accordance with manufacturer's instructions, NECA 402, and NEMA ICS 2.3.
B. Store in a clean, dry space having a uniform temperature to prevent condensation. Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
D. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.
E. Handle in accordance with NEMA ICS 2.3. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.09 FIELD CONDITIONS
A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Motor Control Centers:
B. Substitutions: Not permitted.

2.02 MOTOR CONTROL CENTERS
A. Provide motor control centers consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Description: Dead-front standard (non-arc-resistant) type motor control center assemblies complying with NEMA ICS 18, and listed and labeled as complying with UL 845; ratings, configurations and features as indicated on the drawings.
D. Configuration:
   1. Arrangement: Front-mounted units only (no rear-mounted units or back-to-back configuration).
   2. NEMA Classification and Wiring Type: NEMA ICS 18, Class I, Type B (B-T for units size 3 or smaller).
E. Service Conditions:
   1. Provide motor control centers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide motor control centers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
F. Short Circuit Current Rating:
   1. Provide motor control centers and associated units with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit
study performed in accordance with Section 26 0573.

3. Listed series ratings are not acceptable.

G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

H. Bussing:
1. Horizontal Main Bus: Size for a maximum temperature rise of 117 degrees F over an ambient temperature of 104 degrees F, in compliance with NEMA ICS 18 and UL 845 requirements.
2. Vertical Bus: Minimum size of 300 A, in compliance with NEMA ICS 18 requirements.
3. Provide solidly bonded equipment ground bus through full length of motor control center, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
5. Ground Bus Material: Tin plated copper.

I. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Main and Neutral Lug Type: Mechanical.

J. Enclosures:
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
3. Finish: Manufacturer's standard unless otherwise indicated.

K. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Arrange and equip horizontal bus and ground bus to accommodate future installation of additional motor control sections.
3. Provide a minimum of four (4) one space factor empty spare compartments with blank doors in each MCC.

L. Surge Protective Devices: Comply with Section 26 4300.

2.03 MOTOR CONTROL CENTER UNITS

A. Feeder Units: Circuit breaker type.

B. Combination Magnetic Motor Starter Units:
1. Description: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
2. Configuration: Full-voltage non-reversing type unless otherwise indicated.
3. Disconnects: Circuit breaker type.
   a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
   b. Provide externally operable handle with means for locking in the OFF position. Handle height shall not be more than 79" above finished floor, including height of housekeeping pad. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
   c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Overload Relays: Solid-state type unless otherwise indicated.
5. Pilot Devices Required:
a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.

b. Single-Speed, Non-Reversing Starters:
   1) Selector Switches: HAND/OFF/AUTO.
   2) Indicating Lights: Green ON.

C. Distribution Equipment Units: Where incorporation of low-voltage distribution equipment within motor control center units is indicated, provide suitable components complying with applicable specified requirements.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
   1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
   2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
   3. Trip-free operation.
   4. Visible trip indication.
   5. Resettable.
      a. Employ manual reset unless otherwise indicated.
      b. Do not employ automatic reset with two-wire control.

6. Solid-State Overload Relays:
   a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
   b. Adjustable full load current.
   c. Phase imbalance protection.
   d. Ambient temperature insensitive.
   e. Thermal memory.
   f. Trip test function.
   g. Provide isolated alarm contact.

B. Circuit Breakers:
   1. Interrupting Capacity (not applicable to motor circuit protectors):
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Motor Circuit Protectors:
   a. Provide field-adjustable magnetic instantaneous trip setting.
   b. Provide the following features and accessories on all breakers:
      1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

3. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Minimum Interrupting Capacity:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
1) Provide the following field-adjustable trip response settings:
   (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
   (b) Long time delay.
   (c) Short time pickup and delay.
   (d) Instantaneous pickup.
   (e) Ground fault pickup and delay where ground fault protection is indicated.

2.05 MOTOR CONTROL ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each starter unit, minimum.

B. Pilot Devices:
   1. Comply with NEMA ICS 5; heavy-duty type.
   2. Nominal Size: 30 mm.
   3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
   4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob-lever or gloved-hand operator; number of switch positions as indicated or as required.
   5. Indicating Lights: Push-to-test type unless otherwise indicated.
   6. Provide LED lamp source for indicating lights and illuminated devices.

C. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus 50 VA spare capacity.
   2. Include primary and secondary fuses.

D. Control Terminal Blocks: Include 25 percent spare terminals.

E. Kirk Key Interlocking: Provide keyed interlocking system as indicated on the Drawings.

2.06 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller. Provide test results in a report to be included with O&M Manuals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the motor control centers and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive motor control centers.
D. Verify that conditions are satisfactory for installation prior to starting work.
E. Verify that surfaces are suitable for motor control center installation.
F. Verify that field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Provide housekeeping pads under the provisions of Section 03 3000.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install motor control centers in accordance with NECA 1 (general workmanship), NECA 402, and NEMA ICS 2.3.
C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
D. Provide required support and attachment in accordance with Section 26 0529.
E. Install motor control centers plumb and level.
F. Provide corner sections where indicated, or as required, to fit MCCs within the spaces indicated on the Drawings.
G. Unless otherwise indicated, mount motor control centers on properly sized 3.5 inch high concrete pad constructed in accordance with Section 03 3000.
H. Provide grounding and bonding in accordance with Section 26 0526.
I. Install all field-installed devices, components, and accessories.
J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
K. Set field-adjustable motor controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 0573.
M. Provide filler plates to cover unused spaces.
N. Identify motor control centers in accordance with Section 26 0553.
O. Install motor control centers in accordance with NECA 402.
P. Tighten accessible bus connections and mechanical fasteners after placing motor control center.

3.04 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
C. Before energizing motor control center, perform insulation resistance testing in accordance with NECA 402 and NEMA ICS 2.3.
D. Perform field inspection and testing in accordance with Section 01 4000.
E. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
G. Correct deficiencies and replace damaged or defective motor control centers or associated components.

3.05 ADJUSTING
A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
B. Adjust alignment of motor control center covers and doors.

3.06 CLEANING
A. Clean dirt and debris from motor control center enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred surfaces to match original factory finish.

3.07 CLOSEOUT ACTIVITIES
A. Demonstration: Demonstrate proper operation of motor controllers to Owner, and correct deficiencies or make adjustments as directed.
B. Training: Train Owner's personnel on operation, adjustment, and maintenance of motor control center and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.08 PROTECTION

A. Protect installed motor control centers from subsequent construction operations.

END OF SECTION 26 2419
PART 1  GENERAL

1.01  SECTION INCLUDES
   A.  Wall switches.
   B.  Receptacles.
   C.  Wall plates.

1.02  RELATED REQUIREMENTS
   A.  Section 26 0526 - Grounding and Bonding for Electrical Systems.
   B.  Section 26 0533.16 - Boxes for Electrical Systems.
   C.  Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS
   A.  NECA 1 - Standard for Good Workmanship in Electrical Construction.
   B.  NECA 130 - Standard for Installing and Maintaining Wiring Devices.
   C.  NEMA WD 1 - General Color Requirements for Wiring Devices.
   D.  NEMA WD 6 - Wiring Devices - Dimensional Specifications.
   E.  NFPA 70 - National Electrical Code.
   F.  UL 20 - General-Use Snap Switches.
   G.  UL 498 - Attachment Plugs and Receptacles.
   H.  UL 514D - Cover Plates for Flush-Mounted Wiring Devices.
   I.  UL 943 - Ground-Fault Circuit-Interrupters.

1.04  ADMINISTRATIVE REQUIREMENTS
   A.  Coordination:
       1.  Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
       2.  Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
       3.  Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
       4.  Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
       5.  Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
   B.  Sequencing:
       1.  Do not install wiring devices until final surface finishes and painting are complete.

1.05  SUBMITTALS
   A.  See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
   B.  Product Data:  Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   C.  Project Record Documents:  Record actual installed locations of wiring devices.

1.06  QUALITY ASSURANCE
   A.  Conform to requirements of NFPA 70.
   B.  Manufacturer Qualifications:  Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   C.  Products:  Listed, classified, and labeled as suitable for the purpose intended.
1.07 DELIVERY, STORAGE, AND HANDLING
   A. Store wiring devices in a dry location.
   B. Store in such a manner that the wiring devices will not be damaged.

1.08 WARRANTY
   A. Full warranty against defects in materials and workmanship for one (1) year after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. GE Wiring Devices.
   B. Hubbell.
   C. Leviton Manufacturing, Inc.
   D. Pass & Seymour.
   E. Engineer approved equivalent.

2.02 WIRING DEVICE APPLICATIONS
   A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
   B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
   C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
   D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
   E. Provide GFCI protection for receptacles installed in kitchens.
   F. Provide GFCI protection for receptacles serving electric drinking fountains.
   G. Unless noted otherwise, do not use combination switch/receptacle devices.
   H. Provide Class I Division 1 or Class I Division 2 rated wall switches and receptacles, as required for hazardous environments.

2.03 WIRING DEVICE FINISHES
   A. Provide wiring device finishes as described below unless otherwise indicated.
   B. Wiring Devices Installed in Finished Spaces: Ivory with stainless steel wall plate.
   C. Wiring Devices Installed in Unfinished Spaces: Ivory with galvanized steel wall plate.
   D. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover.

2.04 ALL WIRING DEVICES
   A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.05 WALL SWITCHES
   A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20and where applicable FS W-S-896; types as indicated on the drawings.
      1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
   B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   C. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
2.06 RECEPTACLES
A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
C. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
D. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.07 WALL PLATES
A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   3. Screws: Metal with slotted heads finished to match wall plate finish.
B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
D. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
D. Verify that final surface finishes are complete, including painting.
E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section and other Division 26-28 sections.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switches: 46 inches to center above finished floor.
   b. Receptacle outlets (general): 18 inches to center above finished floor or 6 inches to bottom above counter.
   c. Communications outlets: 18 inches to center above finished floor.
   d. Communications outlets (wall phones): 46 inches to center above finished floor.
   e. Thermostats: 48 inches to center above finished floor.
   f. Pushbuttons: 46 inches to center above finished floor.
   g. Exit lights: 4 inches between top of door frame and bottom of exit sign where possible.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.

5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 26 0553.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.
C. Operate each wall switch with circuit energized to verify proper operation.
D. Test each receptacle to verify operation and proper polarity.
E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING
A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING
A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726
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SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
C. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
C. NEMA AB 1 - Molded Case Circuit Breakers.
D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
F. NFPA 70 - National Electrical Code.
G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
I. UL 98 - Enclosed and Dead-Front Switches.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
E. Project Record Documents: Record actual locations of enclosed switches.
F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
G. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Maintain at the project site a copy of each referenced document that prescribes execution
      requirements.
   C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in
      this section with minimum three years documented experience.
   D. Product Listing Organization Qualifications: An organization recognized by OSHA as a
      Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having
      jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or
      heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to
      enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS
   A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after
      installation of enclosed switches.

1.09 DELIVERY, STORAGE, AND HANDLING
   A. Protect products from weather and moisture by covering with heavy plastic or canvas and by
      maintaining heating within enclosure in accordance with manufacturer's instructions.

1.10 WARRANTY
   A. Full warranty against defects in materials and workmanship for one (1) year after substantial
      completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   B. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   D. Engineer approved equivalent.
   E. Source Limitations: Furnish enclosed switches and associated components produced by the
      same manufacturer as the other electrical distribution equipment used for this project and
      obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES
   A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying
      with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
   B. Provide products listed, classified, and labeled as suitable for the purpose intended.
   C. Unless otherwise indicated, provide products suitable for continuous operation under the
      following service conditions:
      1. Altitude: Less than 6,600 feet.
      2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
   D. Horsepower Rating: Suitable for connected load.
   E. Voltage Rating: Suitable for circuit voltage.
   F. Short Circuit Current Rating:
      1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent
         protective devices to be installed, with listed short circuit current rating not less than the
         available fault current at the installed location as determined by short circuit study
         performed in accordance with Section 26 0573.
G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 12.
      c. Hazardous (Classified) Locations: Type 7/9, as required for the classification of the installed location.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

N. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify enclosed switches in accordance with Section 26 0553.

I. Install enclosed switches using spacers to stand enclosure a minimum of 1/8" from wall or mounting surface.
3.03 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Perform field inspection in accordance with Section 01 4000.
   C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
   D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING
   A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING
   A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
   B. Repair scratched or marred exterior surfaces to match original factory finish.
   C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION 26 2816.16
SECTION 26 4300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Surge protective devices for service entrance locations.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 2419 - Motor-Control Centers.

1.03 ABBREVIATIONS AND ACRONYMS
A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
C. NFPA 70 - National Electrical Code.
D. UL 1449 - Standard for Surge Protective Devices.

1.05 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
C. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).
D. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE
A. Comply with requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION
A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS
A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a
      complete listed assembly including SPD.

B. Source Limitations: Furnish surge protective devices produced by a single manufacturer and
   obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed,
   classified, and labeled as suitable for the purpose intended; system voltage as indicated on the
   drawings.

B. Surge Protection Technology: Metal oxide varistor technology. Silicon avalanche diode
   technology is not acceptable.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service
   disconnect overcurrent device and Type 1 or 2 when connected on load side of service
   disconnect overcurrent device.

D. Protected Modes:

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 480Y/277V System Voltage: Not more than 1,200 V for L-N, L-G, and N-G modes and
      2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal
   system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the
   following installation locations:
   1. Indoor clean, dry locations: Type 1.

H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a
   complete assembly including SPD.
   1. Motor Control Centers: See Section 26 2419.

2.03 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Surge Protective Device:
   1. Unless otherwise indicated, provide factory-installed, internally mounted SPDs.
   3. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
   4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the short circuit current rating
      of the equipment the SPD is connected to, including any series ratings.
   6. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection status for
         each phase.
      b. Remote Status Monitoring: Provide Form C dry type contacts (normally open and
         normally closed) for remote annunciation of status.
   7. Provide surge rated integral disconnect switch for SPDs installed integral to MCCs or
      panelboards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the service voltage and configuration marked on the SPD are consistent with the
   service voltage and configuration at the location to be installed.
B. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

C. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform startup inspection and testing in accordance with manufacturer's instructions.

C. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 4300
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Interior luminaires.
   B. Emergency lighting units.
   C. Exit signs.
   D. Drivers.
   E. Accessories.

1.02  RELATED REQUIREMENTS
   A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   B. Section 26 0529 - Hangers and Supports for Electrical Systems.
   C. Section 26 0533.16 - Boxes for Electrical Systems.
   D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS
   D. NECA 1 - Standard for Good Workmanship in Electrical Construction.
   E. NFPA 70 - National Electrical Code.
   G. UL 844 - Luminaires for Use in Hazardous (Classified) Locations.
   H. UL 924 - Emergency Lighting and Power Equipment.
   I. UL 1598 - Luminaires.
   J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04  ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
      2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
      3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
      4. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05  SUBMITTALS
   A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
   B. Shop Drawings:
      1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include color temperature, color rendering index (CRI), wattage, and initial lumen output.
   b. Include estimated useful life, calculated based on IES LM-80 test data.
   c. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for LED luminaires, including drivers.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRE

A. Provide products that are listed and labeled as complying with UL 1598, where applicable.

B. Provide products that comply with requirements of NFPA 70 and NFPA 101.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.
D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts/drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

G. Provide accessories and fittings as recommended by manufacturer to properly and completely install and wire luminaires.

2.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   3. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

PART 3  EXECUTION

3.01  EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02  PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03  INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install products in accordance with manufacturer's instructions.
D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
E. Provide required support and attachment in accordance with Section 26 0529.
F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.
H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
I. Install accessories furnished with each luminaire.
J. Bond products and metal accessories to branch circuit equipment grounding conductor.
K. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
L. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
M. Install lamps in each luminaire.

3.04  FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect each product for damage and defects.
C. Perform field inspection in accordance with Section 01 4000.
D. Operate each luminaire after installation and connection to verify proper operation.
E. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING
A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.
C. Exit Signs with Field-Selectible Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.
D. Align luminaries at completion of work.

3.06 CLEANING
A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
B. Clean electrical parts to remove conductive and deleterious materials.
C. Clean photometric control surfaces as recommended by manufacturer.

3.07 CLOSEOUT ACTIVITIES
A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. See Section 01 7900 - Demonstration and Training, for additional requirements.
C. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.
D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION
A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5100
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SECTION 32 1313
CONCRETE PAVING

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Standard or slipform Portland Cement Concrete Pavement, reinforced or nonreinforced, including sidewalks, integral curbs, parking areas, roads, and streets.
B. Reinforcing.
C. Work to replace existing pavement removed or damaged during construction.

1.02  REFERENCE STANDARDS
A. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
I. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

1.03  SUBMITTALS
A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Product Data: Provide data on joint filler, admixtures, and curing compound.
C. Certificates: Provide certificates that materials comply with specification requirements, signed by concrete producer and Contractor.
   1. Certify that reinforcing steel meets applicable Specifications.
   2. Certify that sources of Portland cement and aggregates for concrete are Iowa DOT approved. Provide analysis of materials used.
   3. Manufacturer's certification that materials meet specification requirements.
   4. Material content per cubic yard of concrete furnished: dry weight of cement, saturated surface-dried weights of fine and course aggregate, quantities, type and name of admixtures, and weight of water.
   5. Ready-mix delivery tickets, ASTM C94.

1.04  QUALITY ASSURANCE
A. Contractor shall employ and pay for services of the independent laboratory for tests required to show compliance with the specifications. Test results shall be submitted directly to Owner/Engineer. Selection of testing laboratory is subject to approval of Owner/Engineer.
B. Provide samples of materials, job-mix design, gradations and other data for compliance with Section 4100 and 2301 of the Iowa DOT Specifications.

C. Certificates: Provide certificates that materials comply with specification requirements, signed by concrete producer and Contractor.
   1. Manufacturer’s certification that materials meet specification requirements.
   2. Material content per cubic yard of concrete furnished: dry weight of cement, saturated surface-dried weights of fine and course aggregate, quantities, type and name of admixtures, and weight of water.

D. Compressive Strength Method
   1. Prepare at least two concrete compression cylinder or flexural beam strength specimens for each 500 CY placed; prepare at least three strength specimens each day concrete is poured; provide seven day and twenty-eight day tests in accordance with Iowa Department of Transportation Office of Materials-Instructional Memorandum. The testing laboratory will cure and test the concrete test specimens.
   2. Time for opening pavement for use will be determined by results of tests on cylinders taken during concrete placement.
   3. Pavement may be opened to Contractor’s forces after seven (7) days for purpose of removing coverings and building shoulders if tests of cylinders from section show compressive strength of three thousand (3,000) psi or higher.
   4. Concrete placed in cold weather may require additional curing time, as directed by Engineer; keep all vehicles off pavement until such curing time has been completed.

E. Contractor will provide for slump and air content tests during construction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Aggregates: Store and handle aggregates to avoid contamination and frequent variations in specific gravity, gradation or moisture content of materials used.
   1. Store fine and coarse aggregates in separate piles or bins.
   2. Minimize changes in aggregates with different specific gravities or gradations in working day.
   3. Handle aggregates to prevent variations of more than 0.5% in moisture content of successive batches.
   4. Thoroughly wet and allow to drain for at least one hour coarse aggregate having an absorption greater than 0.5%.
   5. Drain fine aggregate at least twenty-four hours after washing and before batching.

B. Cement: Store in suitable weathertight enclosures and handle to prevent loss.
   1. If lumps develop in cement, cement must be reprocessed, retested, and reapproved prior to use.
   2. Cement in storage at site or local warehouses for more than sixty days must be retested prior to use.

C. Admixtures: Store in suitable weathertight enclosures which will preserve quality.

D. Reinforcing Steel: Store off ground on timbers or other supports.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms and Equipment: Conform to Iowa DOT Specifications, Article 2301.07.

B. Wood form material, profiled to suit conditions.

C. Joint Sealer: Conform to Iowa DOT Specification, Section 4136, for hot-poured joint sealer.

D. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751), sponge rubber or cork (ASTM D1752), or Conform to Iowa DOT Specification 4136 for resilient filler or flexible foam expansion joint filler.
2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 80 (80,000 psi) yield strength; deformed billet steel bars; unfinished.
B. Bar Supports: PSI, CRSI Class B or E, fabricated from galvanized wire or having stainless steel legs, epoxy coated.
C. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.
D. Epoxy coated reinforcement: AASHTO M 284 and Iowa DOT 4151.03B, use on all deformed bars and dowel bars and as shown on Drawings.
E. Supports for reinforcing steel:
   1. Support tie bars as required to place and maintain correct location during construction.
   2. Support dowel bars at expansion and contraction joints as shown on Standard Drawings.
   3. Epoxy coated reinforcement: Support with metal chairs and supports coated with epoxy or other inert material reviewed by Engineer; tie with plastic coated tie wires.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type 1.
B. Fine aggregate: Iowa DOT 4110.
C. Coarse aggregate:
   1. Clean, hard, durable particles of crushed limestone free from injurious amounts of objectionable materials; minimum Class 2 durability limestone; Iowa DOT 4115.
   2. Gradation: Iowa DOT 4115, Gradation Number 5.
D. Fly Ash: ASTM C 618, Class C; Iowa DOT 4108.
E. Water: Clean and clear, free from salt, oil, acid, strong alkalis, vegetable matter, or other substances injurious to concrete.
F. Water: Clean, and not detrimental to concrete. If water from a non-potable source is used for mixing, the Engineer may require certification that the water meets the requirements of the appropriate IDOT Specification.
G. Air-Entraining Admixtures: ASTM C260/C260M.
   1. Retarding: A suitable retarding admixture may be used during hot weather, with approval of Engineer.
   2. Calcium chloride shall not be used.
   4. Other admixtures may be used subject to approval of Engineer.

2.04 ACCESSORIES

A. Expansion tubes:
   1. Fabricated steel or plastic tubes; provide tubes with internal diameter 1/16" larger than dowel bar; bar stop capable of withstanding 20 lbs. push, minimum.
B. Metal keyways:
   1. Fabricated 24 gauge sheet steel; conform to details shown on Drawings; provide lengths in multiples of tie bar spacing; punch to receive tie bars; support metal keyway with legs unless installed by paving machine.
C. Liquid curing compound:
   1. Use white curing compounds on all pavements not receiving ACC overlay, as per Iowa DOT 4105.
   2. Use dark colored compounds an all pavements receiving ACC overlay, as per Iowa DOT 4105.
D. Joint Sealer: Conform to Iowa DOT Specification Section 4136 for hot-poured joint sealer.
E. Joint Filler: Conform to Iowa DOT Specification 4136 for resilient filler or flexible foam expansion joint filler.
F. Plastic film: Opaque, white pigmented polyethylene plastic, 0.00085” minimum thickness, use only once if less than 0.0034” thick.

2.05 CONCRETE MIX DESIGN

A. Mix No. C-4 in accordance with Iowa DOT 2301.04.
   1. Air Entraining Admixture: Produce 6.5% + 1.5% air voids in fresh concrete measured by pressure method.
   2. Water Reducing Admixture: Furnish at Contractor's option; Iowa DOT IM 529, but shall not be used in color-conditioned concrete.
   3. Fly Ash: Furnish at Contractor's option; Type C Fly Ash up to 15%; Iowa DOT IM 529; use in accordance of Iowa DOT 2301.04E.

B. Proportion of adjustments:
   1. Basis: When actual quantity of concrete is more than 101% or less than 99% of calculated quantity or if combination of materials does not produce quality of concrete specified.
   2. Fine aggregate shall not exceed 50% of total aggregate in any adjustment.
   3. Do not exceed maximum water-cement ratio specified.

C. Water quality and concrete consistency:
   1. Use proper amount of mixing water to produce concrete of uniform consistency; adapt to mix, characteristics of materials used, methods of consolidation, weather conditions and slope of finished surface.
   2. Modify proportion if maximum water-cement ratio does not produce workability; increase cement to aggregate proportion to produce specified degree of workability without exceeding maximum water-cement ratio.

D. Tests on concrete placed at project site:
   1. Slump: ASTM C 143; 1-1/2” to 3” for machine finished concrete; 4” maximum, for hand finished concrete and color-conditioned concrete.
   2. Air voids of fresh concrete, by pressure method: ASTM C 231; 6.5% + 1.5%.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. Construct in accordance with Iowa DOT Specifications. Section 2115 - Modified Subbase.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.
B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Form all concrete, unless permitted otherwise by Engineer.
B. Use metal or plywood-lined forms for exposed surfaces; erect true to line and grade; brace and tie securely.
C. Coat forms with non-staining mineral oil before placing reinforcing.
D. Place and secure forms to correct location, dimension, profile, and gradient.
E. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
F. Strip forms only after concrete has cured for at least 24 hours and has developed sufficient strength to withstand subsequent stress.
G. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
3.05 REINFORCEMENT
A. Place reinforcement as indicated.
B. Interrupt reinforcement at expansion joints.
C. Place dowels to achieve pavement and curb alignment as detailed.

3.06 COLD AND HOT WEATHER CONCRETING
A. Follow recommendations of ACI 305R when concreting during hot weather.
B. Follow recommendations of ACI 306R when concreting during cold weather.
C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 CONCRETE PROPORTIONING AND MIXING EQUIPMENT
A. Plant batching and mixing equipment shall be Iowa DOT calibrated and approved.
B. Equipment may be either stationary central plant mixer or central plant-proportioned with truck mounted transit mixer.
C. If concrete is central mixed, it may be transported in agitating or non-agitating units.
   1. Concrete must be placed on grade within thirty minutes after mixing if transported in non-agitating units.
   2. Concrete must be placed on grade within ninety minutes after mixing if transported in agitating units.
D. When concrete is mixed on truck mounted transit mixers and agitated thereafter, concrete must be handled in accordance with Iowa DOT 2301.13.D.2.
E. Truck Mounted Transit Mixers: Capacities and mixing capability as defined in ASTM C 94 with attached plate containing required information.
   1. Equipment shall include reliable reset-revolution counter which will register the number of revolutions at mixing speed.
   2. Unit must have signed certifications that concrete producer or authorized representative has inspected unit within previous thirty day period and that interior of mixing drum is clean and reasonably free of hardened concrete, that fins or paddles are not broken or worn excessively, and that other parts are in proper working order.
F. Plant or transit mixers must produce concrete with consistent quality; if uniformity, entrained air or slump varies, concrete producer must take corrective action.
G. Each truck load of concrete must be identified by an acceptable plant charge ticket showing plant name, Contractor, project name, date, quantity, class, time batched, and water added at site.

3.08 PLACEMENT EQUIPMENT
A. Subgrade finishing equipment: use mechanical excavating equipment designed for this purpose, approved by Engineer.
   1. Form line or path area for slip-form paving machine shall be constructed to final grade by form-line excavating equipment with automatic grade controls.
   2. Subgrade between forms or between path areas for slip-form machines constructed to final grade with steel shod template or automatically controlled subgrade excavating machine.
B. Side Forms: Steel, minimum thickness: five gauge, height at least equal to design thickness of pavement, base width at least 6”.
   1. Minimum Section Length: 10’, joint connections designed to permit horizontal and vertical adjustment with locking device to hold abutting sections firmly in alignment when set.
   2. Bracing, support, and staking must prevent deflection or movement of forms from pressure of concrete or weight or thrust of machinery operating on forms.
   3. Forms must be free from scale and surface irregularities; coat with form oil prior to concrete placement.
C. Flexible Forms: Use steel or wood flexible forms for curves with radius less than 100’.
   1. Bracing, support, and staking must prevent deflection or movement of forms from pressure of concrete or weight or thrust of machinery operating on forms.
2. Forms used to form back of curbs at returns shall have height at least equal to design thickness of pavement and curb height.
3. Forms must be free from scale and surface irregularities; coat with form oil prior to concrete placement.

D. Consolidating and finishing equipment: fixed form or slip form paving machines specifically designed for placing, striking off, consolidating, and finishing in single passage to required cross section.
1. Consolidation of concrete by single pass of approved surface, tube or internal vibrator operated in accordance with Manufacturer's recommendations.
2. Slip form equipment: automatic horizontal and vertical controls required; equipment must spread concrete to uniform depth prior to striking off.
3. Air screeds and vibrating screeds are approved consolidating and finishing equipment for cul-de-sacs and drives only.
4. Equipment subject to approval of Engineer.

E. Hand finishing equipment: Contractor shall provide tools including wood or magnesium floats, wood hand floats, pointing trowels, edgers, or other equipment necessary for proper finishing of concrete.
1. Provide two light straightedges, 10' long, with handles not less than 12' long for use in detecting irregularities in surface; provide two heavy straightedges of similar size for use in correcting surface; provide two light straightedges 6" long for checking curb and gutter line.
2. Provide approved vibrators for consolidating concrete.
3. Provide metal or wood screed true to crown.

F. Curing equipment: use pressure sprayer capable of applying a continuous uniform film of curing compound.

G. Concrete saws: power operated concrete saws capable of cutting hardened concrete neatly.

H. Joint sealing equipment: equipment capable of heating and installing sealant in joints in accordance with Manufacturer's recommendations.

3.09 PAVEMENT CONSTRUCTION

A. General:
1. Place, strike off, consolidate, and finish concrete with fixed form or slip form mechanical paving equipment to cross section shown on Drawings.
2. Use paving machine for all uniform width slabs 8" or more in width and 200' or more in length.
3. Use hand placing, consolidating, and finishing in areas of irregular dimensions or narrow widths.
4. Set paving stakes at 25' maximum spacing on curves, 50' maximum spacing on tangents.

B. Setting and removing forms:
1. Use form line excavating machine to establish subgrade for forms used to support mechanical subgrader, mechanical spreader or finisher, or other similar equipment.
2. Set base of forms at or below subgrade elevation with top of forms at pavement surface elevation at edge of slab.
3. Extra height forms may be used to back up integral curb; set base at or below subgrade elevation with top of form at top of curb elevation.
4. Set forms accurately to required grade and alignment and secure in place to maintain grade and alignment during concrete placement and finishing.
5. If voids occur under forms, remove forms and rework subgrade to proper elevation and density.
6. If soil supporting form is softened by rain or standing water so that form is inadequately supported, remove forms and rework subgrade to proper elevation and density.
7. Check form joints with 10' straightedge prior to paving; adjust as necessary to proper grade and alignment; maximum deviation of top surface is 1/4" in 10'.
8. Coat forms with form oil before concrete is placed to prevent adherence to concrete.
9. Leave side forms in place not less than six hours after concrete is placed; if form removal damages concrete, Engineer may require remaining forms to remain in place more than six hours.

10. Remove forms with care to prevent cracking, spalling, or overstressing concrete; remove form stakes prior to raising forms.

11. Clean forms before resetting.

C. Concrete and steel placement:
1. Uniformly moisten subgrade just prior to concrete placement or place plastic film on prepared subgrade, lap joints 12".
2. Adjust manhole castings, valve boxes, or other fixtures within pavement to finished surface grade; clean outside of castings. See Section 02310 - Grading for Fixture Adjustment.
3. Place dowel and tie bars as shown on Standard Drawings or specified; support and secure bars by approved chairs and wire assemblies. Place steel centered in the pavement a minimum of 300' ahead of paving operation.
4. Place concrete to full depth in single operation; do not pile concrete more than 8" above design elevation of surface.
5. Carefully place concrete on subgrade to prevent segregation of materials and at locations which require minimum rehandling; do not displace reinforcing.
6. Vibrate and consolidate to prevent formation of voids; do not displace reinforcing.

D. Finishing:
1. Begin finishing operations promptly after concrete has been placed and consolidated.
2. Screed surface to grade and crown as shown on Drawings.
3. Do not add free water to surface.
4. Finish surface with wood or magnesium floats; finish from both sides simultaneously if pavement is placed to full width with one pass of paving machine.
5. Check surface longitudinally with 10' long straightedge while concrete is still plastic; correct any surface deviations greater than 1/8" in 10'.
6. Provide uniformly gritty surface with astroturf drag; round edges of pavement to 1/8" radius.
7. Check pavement surface longitudinally after concrete has hardened with 10' long straightedge; grind high spots over 1/8" with approved grinding device or device consisting of multiple saw blades.

E. Integral Curb:
1. Construct integral curb as shown on Standard Drawings, along with pavement or immediately following finishing or pavement.
2. Use paving machine with integral slip-form for curb; curb mule or similar mechanical equipment providing equivalent results.
3. Construct depressed curb at driveways and where sidewalk intersect street; use templates to form faces of such curbs.
4. Form and construct curb by hand only where barrier or depressed curb is required and where small radii or other special sections preclude use of mechanical equipment.
5. Construct curb as rapidly as finishing operations on pavement permit; maximum distance behind paving machine: 100'.
6. Remove free water, laitance, dust, leaves, or other foreign matter prior to placing concrete for curb.
7. Use freshly mixed concrete; do not store concrete in receptacles at side of pavement for use in curb at a later time; do not use concrete requiring retempering.
8. Vibrate or puddle concrete to secure bond with paving slab and eliminate rock pockets.
9. Secure final finish on curbs by hand method, including 6' straightedge or 6' slipform.
10. Edge, protect, and cure curb in same manner as pavement.
11. Check surfaces of curb and gutter with 10' straightedge; correct variations greater than 1/8"; remove and replace curbs having varying cross section.

F. Joints:
1. Round edges of concrete adjacent to header boards and preformed joint material to 1/8" radius.
2. Provide supplemental vibration adjacent to header boards and preformed joint material as required.
3. Construct "CD" joint when delays caused by weather conditions, end of day's work, or when concrete placement is interrupted for thirty minutes.
4. Construct double width expansion joint in curb over expansion joint in pavement.

3.10 CURING AND PROTECTION

A. Apply liquid curing compound in fine spray to form continuous, uniform film on surface and vertical edges of pavement and curbs immediately after bleeding stops.
B. Apply compound with power sprayer; rate of application not less than 0.067 gallon per square yard (15 square yards per gallon); do not dilute compound.
C. Apply to pavement surface after finishing and after surface moisture has disappeared; apply to pavement edges within thirty minutes after forms are removed.
D. Protect concrete pavement during cold weather for at least seventy-two hours after placement as follows: (Forecast based on National Weather Service 3:00 p.m. forecast for overnight low.)
   1. Temperature of 35° to 32°F: One layer of burlap.
   2. Temperature of 31° to 25°F: Two layers burlap or one layer plastic film on one layer burlap.
   3. Temperature Below 25°F: 6" layer of straw or hay on top of one layer plastic film. Protect straw or hay from disturbance with a second layer of plastic or burlap.
   5. Commercial insulation may be substituted for straw or hay, when approved by Engineer.
   6. Protect straw, hay, or insulation from disturbance by wind; leave in place for five days, minimum, or until pavement is opened to traffic.
   7. Lap plastic film 18" at junctions.
E. Provide cold weather protection as specified for temperature below 25°F. for all concrete.
F. Provide burlap, paper, or plastic film, and planks and stakes at or near job site to cover and protect fresh concrete and to construct temporary forms for protection against rain.
G. Contractor responsible for pavement protection against effects of weather; failure to properly protect pavement may result in removal and replacement of damaged pavement.

3.11 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.
B. Place concrete in accordance with Iowa DOT Specifications, Section(s) 2301 - Pavement, 2511 - Sidewalks, and 2512 - Curb and Gutter
C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.12 PAVING REPLACEMENT

A. Saw cut edges of removal with saw, concrete cutter, or other equipment which will produce vertical edge; cut pavement full depth.
B. Break up and remove existing concrete or asphalt pavement through use of pneumatic hammer or other suitable equipment; do not damage remaining pavement; remove pavement to existing joint when required to maintain joint spacing greater than two feet (2') and when required by Engineer.
C. Provide temporary granular surfacing on streets and driveways immediately following completion of backfill. Should weather condition or traffic preclude the option of immediately installing the permanent repairs, temporary measures may be taken upon approval of the Engineer.
D. Install and maintain dust abatement control measures until surface replacement is complete.
E. Concrete Pavement: Remove existing concrete pavement full depth and replace with concrete pavement thickness equal to or greater than existing.
F. When new concrete pavement is constructed adjacent to existing concrete pavement install "BD" joint.

G. Concrete Curb and Gutter: Remove existing concrete curb and gutter and replace with new concrete curb and gutter to thickness of existing section or as shown on Standard Drawings; construct new curb to uniform cross section matching existing curb; depress curb at pedestrian curb ramp as shown.

H. Concrete Driveway Removal and Replacement: Remove existing driveways and replace with new concrete driveways as shown on Standard Drawings and as directed by the Engineer; score or saw cut driveway to match existing driveway; protect from traffic for 7 days after the concrete is placed.

I. Concrete Sidewalk Removal and Replacement: Remove existing sidewalk and replace with new concrete sidewalk as shown on Standard Drawings and as directed by Engineer; score sidewalk to match existing sidewalk in sections not less than 9 nor more than 36 sq ft in area; construct expansion joints where sidewalk meets other sidewalk, curb, or fixtures in the surface; construct expansion joint by installing a 1/2 inch, full depth of approved premolded joint material.

3.13 JOINTS

A. Saw cut transverse and longitudinal joints in pavement and integral curb as shown on Drawings.

B. Begin saw cutting as soon as concrete can be sawed without objectionable tearing of sawed edges; complete work within 24 hours after concrete is placed.

C. Saw cutting operation may be conducted at any time. Maintain dust abatement control measures until saw cutting operation is completed.

D. Clean wet sawed joints by water blasting; clean dry sawed joints by air blasting. Resawing of joints may be required if joints are not cleaned adequately.

E. Do not seal joints until concrete is at least three days old and only when pavement and air temperature is 40°F. or higher.

F. Lightly sandblast joint surfaces and clean joint by air blasting as shown on Standard Drawings.

G. Place backer rope and seal as shown on Standard Drawings.

H. Seal all joints before pavement is opened to Contractor's forces and general traffic.

I. Joint type and location to be installed as detailed on the drawings.

J. Provide keyed joints as indicated.

3.14 FINISHING

A. Streets and parking areas in accordance with Section 2301.16 Iowa DOT Specifications.

B. Curb and gutter in accordance with Section 2512.04 of Iowa DOT Specifications.

C. Sidewalks in accordance with Section 2511.05 Iowa DOT Specifications.

D. Allow to cure for 7 days.

E. Area Paving: Light broom, texture perpendicular to pavement direction.

F. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

G. Curbs and Gutters: Light broom, texture parallel to pavement direction.

3.15 RESTRICTIONS ON OPERATIONS

A. Do not place concrete when stormy or inclement weather or temperature prevents good workmanship.

B. Use no aggregates containing frozen lumps and do not place concrete on frozen subgrade.

C. With favorable weather conditions, begin concrete mixing and placement when ambient temperature is at least 34°F. and rising or as directed by Engineer.

D. Concrete delivered to subgrade must have temperature of at least 40°F.
E. Stop concrete mixing and placement when ambient temperature is 38°F. and falling or as directed by Engineer.

F. Stop concrete mixing and placement when ambient temperature exceeds 95°F. or as directed by Engineer.

G. Pavement damaged by inclement weather shall be removed and replaced.

H. Night operation:
   1. Place no concrete when darkness prevents good workmanship in placing and finishing as determined by Engineer.
   2. Do not place or finish concrete under artificial light.

I. Use of pavement:
   1. Time for opening pavement for use will be determined by results of tests on cylinders, beams or maturity meter taken during concrete placement.
   2. Pavement may be opened to Contractor's forces after seven days for purpose of removing coverings and building shoulders or if tests of cylinders, beams or maturity meter from section show compressive strength of 3,000 psi or higher, or flexural strength or 500 psi or higher.
   3. Open pavement to general traffic when approved by authorized authority.
   4. Concrete placed in cold weather may require additional curing time, as directed by Engineer; keep all vehicles off pavement until such curing time has been completed.

3.16 GRADING

A. After the back of the curbs have been cured and the concrete set, fill the area back of the curbs and grade to the level of the top of the curb. The top four (4) inches of backfill shall be approved soil; free of rocks and concrete.

B. The fill back of the curbs shall blend in smoothly with the undisturbed sod in the parking area and shall provide drainage onto the finished pavement.

C. Perform incidental grading on site to eliminate erosion gullies and ruts. Show proper cross section for drainage as directed by the Engineer.

3.17 DEFECTS OR DEFICIENCIES

A. Pavement containing excessive cracks, fractures, spalls, or other defects shall be removed and replaced, or repaired, at no cost to Owner. Severity of defects and remedy, determined by Engineer.

B. Pavement thickness: determined by random cores; one 4" diameter core taken for each section of approximately 1,000 SY.

C. Restore core holes by tamping non shrink cement grout into hole and finish by texturing surface.

D. If the concrete cores taken are less than the specified thickness, remove and replace pavement at no cost to Owner. Deficient thickness pavement will not be accepted.

E. Area represented by each core is one-half of distance to next core or to end of pavement.

F. Additional core samples may be made and measured at Contractor's expense to determine the extent and severity of pavement deficiency.

G. Use Iowa DOT Specifications 2316 - Pavement Smoothness to determine schedule of pavement (use Pavement Chart B). Iowa DOT 2316.06 smoothness incentive shall not be used for this project.

3.18 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
   1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.19 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION 32 1313
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PART 1 GENERAL

1.01 SECTION INCLUDES
A. Equipment Installation Requirements.

1.02 REFERENCES
B. ASME - Boiler and Pressure Vessel Code.
C. AWS D1.1 - Welding in Building Construction.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate location and extent of proposed field welding, and provisions that have been made for type of base metal, present stress conditions, and preheating requirements.
C. Submit certificates for each welder, indicating proof of qualifications as outlined in code, prior to any field welding, either temporary or permanent.

1.04 DELIVERY, STORAGE, AND PROTECTION
A. Receive and unload shipments to plant site from suppliers of equipment under this contract.
B. Unload equipment as soon as possible after arrival.
C. Pay freight car and truck demurrage, detention, and any other costs which may be billed to Owner due to failure to unload cars or trucks within time required by freight companies.
D. Provide physical protection for equipment placed in storage.
   1. Stored equipment shall be supported above ground and shall be covered with canvas or other heavy-duty sheeting. Cover shall be securely fastened and shall be replaced if torn or otherwise damaged during storage period.
   2. Motors shall be stored in dry, warm place and in accordance with manufacturer's recommendations. Motors over 20 hp shall have shaft rotated 90° each month. Provide Engineer with evidence that this requirement is met.
   3. Desiccant shall be maintained between cover and motor frames on motors. Provide desiccant of type permitting visual determination of condition of desiccant. Replace desiccant when it becomes ineffective.
   4. Following items shall be stored in weatherproof, heated (minimum 50°F building complete with bins for storage of small pieces of equipment.
      a. Electronic instruments and cabinets.
      b. Electrical equipment with general purpose enclosures.
      c. Insulation materials.
      d. Rotating equipment.
      e. Miscellaneous electronic equipment, gaskets, and small machined parts.
      f. Instruments and controls.
E. Inspect stored equipment weekly. Renew protective coatings as necessary to preserve fitness of equipment.
F. Provide for safekeeping of materials or equipment received. Store and maintain materials and equipment after receipt until completed installation is accepted by Owner. Such storage and maintenance shall be in accordance with manufacturer's recommendations and requirements of these Specifications. Provide materials, equipment, and labor required for such storage and maintenance.
G. Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance, and shall recondition, repair, or replace any such materials or equipment without additional cost to Owner.
1.05 SERVICE REPRESENTATIVE
A. Provide qualified service representative to perform functions described in Section 01 4000 and to sign Certificate of Proper Inspection attached to Section 01 4000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION
A. Before assembly or erection, thoroughly clean equipment of temporary protective coatings and foreign materials; completely remove shop-applied flushing compounds.
B. Blow out with compressed air as required to remove foreign material.
C. After erection of equipment, clean external surfaces of oil, grease, dirt, or other foreign materials; touch up shop paint, primer, and filler; leave surfaces smooth and ready for finish painting.

3.02 INSTALLATION
A. Install in strict accordance with manufacturer’s instructions.
B. Provide access space around equipment for service. Provide no less than minimum as recommended by manufacturer.

3.03 SPECIAL ERECTION PROCEDURES
A. Field welding to existing structural members shall conform to following requirements:
   1. Conform to AWS D1.1.
   2. Welding to high strength steels or preheating of highly-stressed members will not normally be permitted.
   3. Remove any temporary welded attachments, grind area smooth, and apply one coat of primer to match existing primer.
B. Welding of piping shall conform to ANSI B 31.1 Code for Power Piping and ASME Boiler and Pressure Vessel Code, Section IX when either or both are applicable.
C. Remove any temporary attachments made to equipment. Grind area of attachment on equipment to smooth surface and apply one coat of primer to match existing primer.

3.04 SPECIAL EQUIPMENT TO BE PROVIDED
A. Provide dowel pins and shims necessary for leveling and doweling equipment to baseplates. Shims shall be stainless steel.
B. Provide bolting required to anchor equipment securely to building structural steel; holes required in structural steel shall be drilled; burning with cutting torch not allowed.
C. Provide expansion anchors where required, subject to review by Engineer. Use appropriate type of anchor devices on vibratory equipment.
D. Provide welding rod for field erection of equipment installed under this contract.

3.05 FLOOR SHORING
A. Shore any parts of structure for which design loading would be exceeded during construction or installation of equipment.
B. Protect flooring and other finished surfaces by means of heavy planking.
C. Remove shoring and repair any damage to floors or other parts of structures after equipment has been installed.

3.06 EQUIPMENT ALIGNING
A. Align equipment in accordance with manufacturer’s recommendations.
B. Use shims of sheet and plate steel; use shims with laminations having individual layers not heavier than 0.015" for 1/32" to 1/8" directly under equipment.
C. Check alignment of equipment after piping and other external connections have been made and before equipment is placed in operation. Realign equipment as necessary.
D. After alignment, hot run and recheck alignment; drill and ream items of equipment and fasten to baseplates with tapered dowel pins.
E. Include costs for labor required to obtain alignment within allowable limits on equipment installed and for any hanger adjustments required.

3.07 EQUIPMENT SUPPORTS
A. Provide devices to support equipment.
B. Fabricate supports of structural steel sections, plates, or rods arranged to provide rigid and sturdy mounting for equipment.
C. Provide connections or fasteners required between equipment supports and building structure.
D. Equipment foundation pads: As indicated on drawings.
E. Provide devices to support equipment piping and appurtenances where specific support is not detailed on Drawings. Support piping adjacent to equipment such that no weight is carried on equipment.

3.08 GROUTING
A. Place a minimum of 1” nonshrink grout under equipment being mounted on concrete foundations unless specified otherwise.
B. Determine quantity of grout required.
C. Space between top of foundation and bottom of equipment base shall be filled with grout, free of any voids.
D. Place no grout that has been allowed to set, after mixing, beyond time limitations set forth by grout manufacturer.

END OF SECTION 46 0500
SECTION 46 4124  
VERTICAL SHAFT MIXERS

1.01 SECTION INCLUDES

A. Top mounted vertical shaft mixer for mixing blended sludge (BSL) in existing tanks.

1.02 REFERENCES

A. NEMA MG1 - Motors and Generators.
B. AGMA

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop drawings showing arrangement, dimensions, and materials.
C. Characteristic performance data for mixers including:
   1. Efficiency
   2. Brake horsepower
   3. Operating Point
   4. Impeller diameter
   5. Bearing Life
   6. AGMA service factor
   7. Net Weight of Mixer and Baseplate
D. Motor Data:
   1. Documentation that motors provided are premium efficiency units.
   2. Nameplate data.
   3. Service factor on motors 1/2 HP and above.
   5. NEMA frame size.
   6. NEMA design code.
   7. Insulation type and temperature rise.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Operation and maintenance manuals according to Section 01 7800.

1.04 DELIVERY, STORAGE, AND HANDLING

A. As Described in Section 46 0500, Equipment Installation.

1.05 SERVICE REPRESENTATIVE

A. Provide qualified service representative to perform functions described in Section 01 4000 and to sign the Certification of Proper Inspection attached to Section 01 4000.
B. Include necessary trips by the manufacturer's representative to provide four (4) 8-hour work days on-site (travel time not included) for startup and training of operations personnel (one (1) day for each tank start-up plus an additional day for training off-cycle operations personnel). Training may be video taped by Owner.
C. Additional trips required by the Contractor before or after final startup and training shall not be charged to the Owner.

1.06 QUALITY ASSURANCE

A. All mixing equipment shall be products of a single manufacturer.
B. Mixer manufacturer shall be engaged in design and fabrication of vertical bridge mounted mixers, including solids handling type for wastewater service for the last 10 years.
   1. Minimum of 25 similar units installed and operated successfully in the U.S.
1.07 WARRANTY
A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Mixtec North America, 2000 Top Entry.
B. Engineer approved equivalent.

2.02 GENERAL
A. Furnish 12 top mounted vertical shaft mixers and related equipment accessories including:
   1. Motor.
   2. Gear Drive.
   3. Impeller Shaft.
   4. Impeller.
   5. Mounting: Raised Baseplate.
   6. Appurtenance items to make a complete and operable system.
B. Mixer sizing and design shall be suitable for mixing contents of existing tank(s). Tanks are rectangular with a fillet located along far wall sloping towards the center of the tank.
   1. Tank 1
      a. Length (ft.): 38.
      b. Width (ft.): 6.
      c. Mixers: 4
   2. Tank 2
      a. Length (ft.): 20.
      b. Width (ft.): 6.
      c. Mixers: 2
   3. Tank 3
      a. Length (ft.): 52.
      b. Width (ft.): 6
      c. Mixers: 6
   4. High Water Lever (HWL.) (SWD), ft.: 6'-10"
   5. Low Water Level (LWL) (SWD), ft.: 1'-4"
   6. Mounting Elev: As indicated on drawings.
C. Tank contents:
   1. Blended Sludge.
   2. Anticipated Solids Percentages:
      a. Maximum solids percentage (%): 9
      b. Average solids percentage (%): 5.5
      c. Minimum solids percentage (%): 3

2.03 MIXER MOTOR
A. The motor shall deliver 1.5 horsepower at 1200 RPM or 1800 RPM suitable for 480 volt, 60 cycle, three phase service and capable of running with a VFD attachment.
B. The motor shall be an AC squirrel cage induction motor, explosion proof fan cooled (TEFC) premium efficiency, and rated for Class 1, Division 2 Groups C and D.
C. The motor shall in all cases equal or exceed standard NEMA specifications.
D. The motor winding insulation shall in all cases equal or exceed NEMA Class F design and Class B temperature rise.
E. Minimum service factor: 1.15.
F. Motor shall be connected to reducer with a suitable C-face adapter using a one-piece coupling.
G. The mixer shall be designed to operate at 85% of the motor nameplate rating
H. B10 Bearing life no less than 50,000 hrs.
I. A stainless steel nameplate shall be provided with each motor, and shall be securely fastened thereto. The voltage, speed, phase, insulation class, amperage, service factor, wiring diagram, motor serial number, mixer ID, and manufacturer’s name and address shall be stamped thereon or otherwise permanently marked.

2.04 GEAR DRIVE
A. Gear drive shall be commercially available and not proprietary to the mixer manufacturer.
B. The gear drive shall be helical, parallel shaft gear drive.
C. Shall be specifically designed for mixing duty and shall be suitable for 24hr/day continuous operation. The speed reducer shall be of a modular design with a housing material of gray cast iron.
D. All of the main components will be contained in a one-piece housing. All bearing bores, pilots, and registers of the housing will be machined in one set-up.
E. General Maintenance, specifically including replacement of all anti-friction bearings, oil seals and bearings and lubricant maintenance will not require removal of the drive housing from its foundation.
F. The drive shall be a parallel helical design with a combination of helical and spiral bevel gearing. Drive units having a pinion mounted directly on the motor shaft will not be acceptable. Bearings above and below the reducer to stabilize the unit are not compliant. Worm gears and planetary gearing is not acceptable.
G. Oil Leakage down the low-speed upper shaft shall be prevented by means of an "Effective Drywell". Drive shall employ an Effective Drywell design to prevent contamination of mixing medium from lubricant leakage. Output shaft shall have two intermediate shaft seals to hold lubricant in the gear case. In case of lubricant leakage through the lower shaft seals the lubricant will run over an oil slinger placing the leakage into a safety chamber in the flange below the gear case. Lubricant will collect at the lowest point at which an oil indicator or oil sensor is placed. Oil will run over an oil slinger placing the leakage into a safety chamber in the flange below the gear case. Lubricant will collect at the lowest point at which an oil indicator or oil sensor is placed. On the output shaft below the oil slinger will be a grease packed spherical roller bearing followed by another seal to assure there will be no leakage. A sight glass shall be provided to display any leakage.
H. Lubrication for the reducer shall be food grade synthetic gear oil, which will have an equivalent viscosity of ISO VG 220. The oil will operate with an ambient temperature range of 20 to 104 F (-5 to 40 C).
I. Gear drive lubrication shall be achieved by immersion of gears and bearings in an oil bath or splash lubrication. The lubrication shall not require priming, heaters, or other special effort or equipment for start-up in extremely cold or highly variable climates.
J. Reducer will have a check-valve with a spring pressing a ball against a machined orifice to allow the reducer to dissipate internal pressure while preventing lubricant contamination during cooling.
K. A single oil drain shall be provided at the lowest point of the reducer to allow oil drainage and a minimum residual of oil no more than ¼” in the drive housing.
L. The AGMA service factor shall be not less than 2.0 based on full motor nameplate horsepower. The thermal rating of the speed reducer shall exceed the design mechanical rating to eliminate the need for external cooling devices. External cooling devices are not permitted.
M. All drive bearings shall have a minimum B-10 bearing rating of 100,000 hours based on full motor nameplate horsepower. All bearings shall be immersed in lubricating oil or if they above the oil level they will be sealed with nylon rings and grease packed to ensure positive lubrication.
N. The drive housing shall be provided with a sight glass to observe oil levels.
O. Foot steady bearings or slap rings are not allowed.

2.05 MOTOR BASE ASSEMBLY
A. The motor shall be securely mounted onto a solid 316 stainless raised steel baseplate.
B. Baseplate shall have a minimum of 9.5" clearance from mounting surface to allow sufficient space to install rigid coupling to vertical shaft.

C. Baseplate shall include 316 stainless steel removable hatch for access to rigid coupling.

D. Baseplate anchors and mounting arrangement shall be as detailed in contract drawings.

2.06 IMPELLER SHAFT
   A. Impellor shaft shall be a 4" Schedule 40 316 SS pipe.
   B. Combined torsional and bending stresses shall not exceed the following:
      1. Shear (psi): 6,500
      2. Tension (psi): 11,500
   C. The shaft shall include an in-tank coupling for ease of installation into the basins.
   D. Connection to reducer shaft shall be through rigid flanged coupling.

2.07 COUPLING
   A. The rigid flanged coupling shall be in two parts, female section to shaft & male section to reducer.
   B. Each coupling half shall be heat shrunk on to shaft member.
   C. Material shall be 316 SS for both coupling halves.
   D. The coupling assembly(s) shall be located:
      1. Within the raised baseplate support structure above the concrete.

2.08 IMPELLER
   A. Impeller diameter (inches):16.
   B. Impeller material: 316 SS
   C. Impellers per Mixer: 3
   D. The impeller shall be a curved blade turbine radial flow type with an anti-vortexing disc specifically designed to be anti-snag and to prevent instability at low mixing levels.
   E. The impeller blades shall be welded to the hub which in turn shall be welded to the shaft.

2.09 BALANCING
   A. The shaft shall be dynamically straightened with run out of no greater than 1/4" per 10' of shaft length.
   B. Measurements shall be taken at a frequency equivalent to the motor RPM.
   C. Measurements shall be taken with the motor in a vertical, shaft down position and with the motor or the entire power section mounted on resilient pads.

2.10 CONTROL SYSTEM OVERVIEW
   A. Control of the vertical mixers shall be provided through the plant control system. See Section 25 5100 for functional control description.

2.11 PAINTING
   A. Motor and Drive shall be painted to manufacturer's stand specification and color coding, but not less than the industry standard for such equipment.
   B. Stainless steel components shall not be painted.

PART 3 EXECUTION
3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions and Section 46 0500, as indicated on drawings, by qualified craftsmen.
   B. Location, orientation, and quantities as indicated on drawings.
   C. Include all required related items necessary for a complete installation.
   D. Coordinate for compatibility of manufacturer's shop coating and final finish.
E. Support and anchor as indicated on drawings.
F. Start up in presence of manufacturer's service representative.
G. Test power draw and balancing during initial operation with manufacturer's service representative.

END OF SECTION 46 4124
CITY OF DES MOINES GENERAL SUPPLEMENTAL SPECIFICATIONS TO THE SUDAS STANDARD SPECIFICATIONS, 2022 EDITION
Effective Date: March 21, 2022

This project will be constructed in accordance with the SUDAS Standard Specifications, 2022 Edition, which were adopted by the City of Des Moines on March 7, 2022, under Roll Call No. 22-0308, as amended by these City of Des Moines General Supplemental Specifications.

The SUDAS Standard Specifications, 2022 Edition, may be viewed at the Iowa SUDAS website https://iowasudas.org/manuals/specifications-manual/ , or can be purchased online from the Iowa SUDAS website at: https://iowasudas.org/order-the-manuals/.

Said SUDAS Standard Specifications are hereby amended as follows:

SECTION 1010 – DEFINITIONS

1010, 1.03 DEFINITIONS AND TERMS. Add the following new definition:

PRIVATE CONSTRUCTION CONTRACT. A contract awarded by a private agency or individual for construction of a publicly owned or privately-owned improvement, which by agreement of the parties is subject to these specifications.

SECTION 1020 – PROPOSAL REQUIREMENTS AND CONDITIONS

1020, 1.01 QUALIFICATION OF THE BIDDERS: Add the following new E.

E. The City of Des Moines may disqualify a Contractor from bidding on future work or from participating as a subcontractor for a period of up to 3 years in accordance with Section 94-198 of the Municipal Code of the City of Des Moines.

1020, 1.03 QUANTITIES AND UNIT PRICES: Delete B. and replace with the following new B.

B. When unit prices are requested in the proposal form, the quantities indicated on the proposal form are approximate only, and do not constitute a warranty or guarantee by the Jurisdiction as to the actual quantities involved in the work. Such quantities are to be used for the purpose of comparison of bids and determining the amount of bid security, contract, and performance, payment, and maintenance bond. In the event of discrepancies between unit prices and unit price extensions listed in a bidder’s proposal, unit prices shall govern and unit price extensions shall be corrected, as necessary, for agreement with unit prices; except in the case of an obvious, serious, clerical error where the Engineer is able to determine the bidder’s intent from the proposal; in which case, the Jurisdiction may waive irregularities that are in best interest of the Jurisdiction, as long as the integrity of the bid process can be maintained. The Jurisdiction expressly reserves the right to increase or decrease the quantities during construction as outlined in Section 1040, 1.06 - Increase or Decrease of Work, and to make reasonable changes in design, provided such changes do not materially change the intent of the contract. The amount of work to be paid for shall be based upon the actual quantities performed.
1020, 1.09 PREPARATION OF THE PROPOSAL: Delete D. and replace with the following D:

D. When unit prices are requested, they shall be submitted on each and every item of work included for which bids are requested. The format for unit prices will be in dollars and whole cents only. In the case of discrepancy, the unit price shall govern; except in the case of an obvious, serious, clerical error where the Engineer is able to determine the bidder’s intent from the proposal; in which case, the Jurisdiction may waive irregularities that are in best interest of the Jurisdiction, as long as the integrity of the bid process can be maintained.

1020, 1.15 LIMITATION ON WITHDRAWAL OF PROPOSALS AFTER OPENING OF PROPOSALS: Add the following new C:

C. After bids are opened, if the low bidder claims that it has made a serious error in the preparation of its bid, and can support such a claim with evidence satisfactory to the Jurisdiction, said bidder shall be allowed to withdraw its bid and its bid security shall be returned; provided however, as a condition for return of its bid security, said bidder shall be required to agree that it will not be allowed to again bid on the project, either as a prime bidder or as a subcontractor, if the project, or a substantial portion of the project, is rebid within six months of the first bid opening. Under no circumstances should said bidder be permitted to alter or adjust its bid, as this would undermine the entire system of competitive bidding and be an open invitation to abuse.

SECTION 1040 – SCOPE OF WORK

1040, 1.05 PLANS: Delete the 2nd paragraph and replace with the following:

Electronic support files, will not be provided prior to letting and may be provided to the low bidder and are for information only. Should there be a discrepancy between an electronic support file and a contract document, the contract documents shall govern. No guarantee is made that the data systems used by the Engineer will be directly compatible with the systems the Contractor uses.

1040, 1.07 CHANGE ORDERS, B. Written Orders: Add the following to the end of the section:

Formal approval by the Jurisdiction shall be defined as follows:

The authority of the Des Moines City Manager and the Engineer to approve change orders shall be limited to those change orders which will cost $50,000 or less. Change orders for work to cost more than $50,000 shall be approved by the City Council prior to the payment of the work provided for under the change order.

1040, 1.09 CHANGED SITE CONDITIONS, A. Latent or Subsurface Conditions: Delete 1. and 2. in their entirety and replace with the following 1. and 2.; and add the following new 3.

1. If the Contractor encounters latent or subsurface conditions differing materially from those indicated in the contract documents which the Contractor could not have discovered by a reasonable site investigation and examination of the type customarily undertaken by prudent and competent contractors, and if these changed conditions are considered by the Contractor as a basis for compensation in addition to the contract price, the Contractor shall within three working days after discovery thereof notify the Engineer of its claim by written notice as sent
set forth herein. Before disturbing the site at which the latent or subsurface condition is alleged to exist, the Contractor shall give the Engineer the opportunity to inspect the same.

a. For claims greater than $50,000 the Contractor shall notify the Engineer by written notice either (i) personally delivered, (ii) sent by certified mail, return receipt requested, or (iii) delivered by a nationally recognized prepaid overnight courier service (receipt requested), to the address below:

   City of Des Moines
   Engineering Department
   400 Robert D. Ray Drive
   Des Moines, IA  50309-1891
   Attention:   Steve Naber, P.E., City Engineer

Under no circumstance will an email, text message, verbal communication or any other informal communication, be considered acceptable or satisfactory written notice required by this section. The written notice shall:

1) Expressly state that it is a request for a contract change under Section 1040, 1.09;
2) Expressly identify the latent or subsurface conditions that the Contractor alleges differ materially from those indicated in the contract documents which the Contractor could not have discovered by a reasonable site investigation and examination of the type customarily undertaken by prudent and competent contractors;
3) Expressly state the reason the Contractor believes extra compensation is due;
4) Identify work that Contractor alleges will be impacted.

b. For claims less than $50,000 the Contractor shall notify the Project Engineer by written notice sent as set forth above or sent by email providing the same detail as identified in a.1) through 4) above. Under no circumstances will a text message, verbal communication or any other informal communication be considered acceptable or satisfactory written notice required by this section.

2. After inspection by the Engineer, the Jurisdiction may, in its discretion, authorize the Contractor to proceed with or abandon the work. The Contractor shall resume construction operations pending a decision regarding its claim by the Jurisdiction. Failure of the Contractor to give written notice within three working days of discovering the conditions and to give the Engineer full opportunity to inspect the condition before disturbing the site shall be deemed a waiver by the Contractor of all claims for extra compensation arising out of the alleged condition.

3. Latent or subsurface conditions that do not materially differ from those shown on the plans shall not form the basis for additional compensation. No additional compensation or extension of time shall be provided for conditions that do not materially differ, regardless of the nature of the condition encountered.

**1040, 1.10 DISPUTED CLAIMS FOR EXTRA COMPENSATION:** Delete 1.10 in its entirety and replace with the following:

**A. Basis of Claim for Extra Compensation:**

1. In any case where the Contractor believes extra compensation is due for work or material beyond the scope of the Work under the contract and not ordered by the Engineer as Extra Work as defined in Section 1010, 1.03, the Contractor shall provide written notice to the Engineer, as set forth herein, of its intention to make claim for such extra compensation within thirty (30) days of discovering the circumstances regarding the claim and before beginning the work on which the claim is based (hereinafter referred to as a “Claim”).
a. For claims greater than $50,000 the Contractor shall notify the Engineer by written notice either (i) personally delivered, (ii) sent by certified mail, return receipt requested, or (iii) delivered by a nationally recognized prepaid overnight courier service (receipt requested) to the address below:

   City of Des Moines  
   Engineering Department  
   400 Robert D. Ray Drive  
   Des Moines, IA  50309-1891  
   Attention: Steve Naber, P.E., City Engineer

Under no circumstance will an email, text message, verbal communication or any other informal communication, be considered acceptable or satisfactory written notice required by this section. The written notice shall:

1) Expressly state that it is a request for a contract change under Section 1040, 1.10;  
2) Expressly state the reason the Contractor believes extra compensation is due;  
3) Identify the underlying work or material that Contractor claims is beyond the scope of the Work under the contract and not ordered by the Engineer as Extra Work as defined in Section 1010, 1.03;  
4) Identify any work that will be impacted.

b. For claims less than $50,000 the Contractor shall notify the Project Engineer by written notice sent as set forth above or sent by email providing the same detail as identified in a.1) through 4) above. Under no circumstances will a text message, verbal communication or any other informal communication be considered acceptable or satisfactory written notice required by this section.

The Contractor shall not proceed with that work until the Contractor and the Jurisdiction have executed a change order with respect to the Claim. The Contractor shall have no right to submit a Claim for any matter which is exclusively reserved to authority of the Engineer under the Contract Documents.

2. The Jurisdiction shall not be responsible for damages attributable to the performance, nonperformance, or delay, of any other contractor, governmental agency, utility agency, firm, corporation, or individual authorized to do work on the project, except if such damages result from negligence on the part of the Jurisdiction, its Engineer, or any of its officers or employees.

3. For any Claim, if such written notification is not given, or if after such written notification is given the Engineer is not allowed facilities for keeping strict account of actual costs as defined for force-account construction, the Contractor thereby agrees to waive the Claim for extra compensation for such work. Such written notice by the Contractor, and the fact the Engineer has kept account of the cost as aforesaid, shall not be construed as establishing the validity of the Claim.

4. The Claim, when filed, shall be in writing and in sufficient detail to permit auditing and an evaluation by the Jurisdiction. The Claim shall be supported by such documentary evidence as the Contractor has available and shall be verified by affidavit of the Contractor or other person having knowledge of the facts.

B. Presentation and Consideration of Claim: If the Contractor wishes an opportunity to present its Claim in person, the Claim shall be accompanied by a written request to do so. Where the Contractor asks an opportunity to present its Claim in person, the Jurisdiction, within thirty (30) calendar days of the filing of the Claim, shall fix a time and place for a meeting between the Contractor and the Jurisdiction or its designated representatives or representative. The Jurisdiction shall, within a reasonable time after the filing of the Claim or the meeting above
referred to, whichever is later, rule upon the validity of the Claim and notify the Contractor, in writing, of its ruling together with the reasons therefore. In case the Claim is found to be just, in whole or in part, it shall be allowed and paid to the extent so found.

C. Request for Claim Review: In the event a Contractor’s Claim as outlined in the above procedure in Sections 1040, 1.10(A) and (B) has been disallowed, in whole or in part, the Contractor may, within thirty (30) calendar days from the date the ruling of the Jurisdiction is mailed, make a written request to the Jurisdiction that its Claim or Claims be submitted to a board of review. The written request shall be either (i) personally delivered, (ii) sent by certified mail, return receipt requested, or (iii) delivered by a nationally recognized prepaid overnight courier service (receipt requested) addressed as follows:

City of Des Moines
Engineering Department
400 Robert D. Ray Drive
Des Moines, IA  50309-1891
Attention: City Engineer

The Jurisdiction shall decide if the matter is subject to further review and shall, within thirty (30) calendar days of the receipt of the request for review, grant or deny the request for review. The Jurisdiction’s decision shall be final. In the event the Contractor fails to make a timely written demand for review of its Claim as provided by this Section 1040, 1.10(C), the decision of the Jurisdiction shall be deemed to be final and the Contractor shall have no right to pursue arbitration or litigation of its Claim.

D. Board of Review:

1. The Board shall have jurisdiction to pass upon questions involving compensation to the Contractor for work actually performed or materials furnished and upon claims for extra compensation that have not been allowed by the Jurisdiction. The Board’s jurisdiction shall not extend to matters exclusively reserved to the Engineer, to a determination of quality of workmanship or materials furnished, or to an interpretation of the intent of the Plans and Specifications except as to matters of compensation. Jurisdiction of the Board shall not extend to setting aside or modifying the terms or requirements of the contract.

2. Following the timely written demand for review of the Claim and the decision of the Jurisdiction to grant the request, a board of review shall be appointed to review the Claim. The board of review shall consist of three (3) members as follows: the Engineer, or designated representative; and two persons to be appointed by the Engineer (hereinafter the “Board”).

3. The Board shall set a date for the Contractor to present its Claim for review within sixty (60) days of the date the Jurisdiction issued its decision granting the Contractor’s request for review. The presentation before the Board shall not be in accordance with the Iowa rules of civil procedure and the Contractor shall not have the right to conduct discovery or compel the testimony of witnesses as part of the presentation. The Contractor shall submit three (3) copies of a written Claim summary and all documents it considers to be relevant to its Claim at least fourteen (14) days prior to the date set for the presentation before the Board. The presentation before the Board is intended to be an informal process to allow the Contractor to further explain its Claim and why it believes it is entitled to additional compensation. The Board reserves the right to impose such rules as it deems reasonably necessary to allow for a fair and efficient presentation.

4. Following the presentation before the Board, the Board shall render a written decision regarding the Claim within twenty (20) days of the presentation. In the event the Board renders a decision in favor of the Contractor for some or all of the Claim, the Contractor and the Jurisdiction shall promptly proceed in good faith to prepare a change order consistent with the decision of the Board. If the Board denies the Claim, in part or in full, the Contractor’s
sole and exclusive remedy is to demand final resolution of the Claim that has been denied subject to the procedure provided below.

E. **Final Resolution by Binding Arbitration or Litigation:** For any Claim denied by the Board, the Jurisdiction shall have the sole and exclusive right to determine whether final resolution of the Claim shall be through Binding Arbitration or litigation. The Contractor shall not have the right to pursue final resolution of any Claim that the Contractor did not submit to the Board. The Contractor must make a written demand for final resolution of the Claim upon the Jurisdiction within thirty (30) days of the date when the Board rendered its decision or it will be deemed to have waived this right and the decision of the Board will be final. The written demand shall be either (i) personally delivered, (ii) sent by certified mail, return receipt requested, or (iii) delivered by a nationally recognized prepaid overnight courier service (receipt requested) addressed as follows:

City of Des Moines  
Engineering Department  
400 Robert D. Ray Drive  
Des Moines, IA 50309-1891  
Attention: Steve Naber, P.E., City Engineer

The Jurisdiction shall notify the Contractor within thirty (30) days of the date of receiving the Contractor’s written demand for final resolution of the Claim, whether the Jurisdiction will elect to use binding arbitration or litigation to reach a final resolution of the Claim. The decision to pursue binding arbitration or litigation, shall be the sole and exclusive decision of the Jurisdiction. The decision of the Jurisdiction on whether to pursue binding arbitration or litigation is final.

1. **Arbitration.**

(a) If the Jurisdiction elects to use binding arbitration for final resolution of the Claim, the sole and exclusive remedy for final resolution of the Claim shall be binding arbitration (the “Arbitration”). The Arbitration shall be submitted to a single arbitrator as is mutually agreed upon by the Contractor and Jurisdiction. If the Contractor and Jurisdiction cannot agree upon a single arbitrator within twenty-one (21) days of the date of the Jurisdiction’s notification to the Contractor of the Jurisdiction’s decision to pursue binding arbitration, the Arbitration shall be submitted to a three (3) member panel appointed as follows: the Contractor shall appoint one arbitrator; the Jurisdiction shall appoint one arbitrator; and the third arbitrator shall be chosen by the first two appointed arbitrators (for the sake of convenience, the arbitrator, or arbitrators as the case may be, shall be referred to hereinafter as the “Arbitrator”). The parties agree to work toward appointment of a three (3) member Arbitration panel within twenty-one (21) days after not being able to agree on a single arbitrator. The Arbitration shall be conducted in general accord with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect. The parties reserve the right to alter and amend the rules for the Arbitration as they may mutually agree in writing.

(b) The Arbitrator shall have jurisdiction to pass upon questions involving compensation to the Contractor for work actually performed or materials furnished and upon claims for extra compensation that have not been allowed by the Jurisdiction. The Arbitrator’s jurisdiction shall not extend to matters exclusively reserved to the Engineer, to a determination of quality of workmanship or materials furnished, or to an interpretation of the intent of the Plans and Specifications, except as to matters of compensation. Jurisdiction of the Arbitrator shall not extend to setting aside or modifying the terms or requirements of the contract.
(c) Subject to agreement of the parties and the Arbitrator, the parties shall work in good faith to schedule the Arbitration and allow for the decision of the Arbitrator within two hundred forty (240) days after appointment of the Arbitrator.

(d) The Arbitrator shall render a written decision within twenty (20) days after the Claim has been fully submitted. For Arbitrations before more than one arbitrator, the decision of a majority of the panel shall govern. The Arbitrator’s decision shall provide a basis for the findings and legal conclusions and shall determine how the cost of the proceedings shall be borne by the parties.

(e) The decision of the Arbitrator shall be binding and final. There shall be no further appeal or judicial review, except under the limited circumstances as allowed by Iowa law.

2. Litigation.

(a) If the Jurisdiction elects not to use arbitration as the means to reach final resolution of the claim, then the sole and exclusive remedy for final resolution of the Claim shall be litigation which must be brought in Iowa District Court in and for the County where the Jurisdiction is located or in the United States District Court in and for the District where the Jurisdiction is located.

(b) To the fullest extent permitted by law, Contractor and Jurisdiction hereto waive any right each may have to a trial by jury in respect of litigation directly or indirectly arising out of or in connection with this Agreement.

SECTION 1050 – CONTROL OF WORK

1050, 1.10 PROTECTION OF LINE AND GRADE STAKES: Add the following new D.

D. The Jurisdiction shall provide all construction survey staking on projects funded by the Jurisdiction unless otherwise indicated on the plans or in the Contract Documents. On Private Construction Contracts, the Owner, in accordance with the Private Construction Contract, shall hire a Licensed Surveyor for all survey work.

SECTION 1060 – CONTROL OF MATERIALS

1060, 1.03 SAMPLES AND TESTING: Add the following new D.

D. All on-site inspection and testing, as well as testing of materials, will be provided by the Jurisdiction unless otherwise indicated on the plans or by special provisions.

SECTION 1070 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

1070, 1.03 PERMITS AND LICENSES: Delete and replace with the following:

The Contractor shall procure and pay for all necessary permits and licenses for the construction of the work and for temporary excavations, obstructions, enclosures, and street openings arising from the construction and completion of the work described in the Contract Documents. The Contractor shall be responsible for all violations of the law for any cause in connection with the construction of the work or caused by the obstruction of roads, streets, highways or sidewalks, and shall give all requisite notices to the Jurisdiction or other public authorities in connection therewith.
6. The City of Des Moines, Engineering Department, Master Construction Safety Packet is available in the Forms and Documents section at the Engineering page on the City of Des Moines website at:


and is also available upon request from the Engineering Department. The Engineering Department will make available a copy of the City of Des Moines Master Construction Safety Plan to the Contractor when the contract is awarded. Said Safety Plan is for the Contractor’s information only and it is the Contractor’s sole responsibility to provide, or make available, this safety information to all its Subcontractors.

1070, 1.12, CONSENT TO JURISDICTION OF IOWA DISTRICT COURT OR FEDERAL DISTRICT COURT: Delete 1.12 in its entirety and replace with the following new 1.12:

1070, 1.12  DISPUTE RESOLUTION AND CONSENT TO JURISDICTION OF IOWA DISTRICT COURT OR FEDERAL DISTRICT COURT IN IOWA

A. The Contractor agrees any claims, disputes, causes of action that accrue to it, or which by subrogation or assignment accrue to its sureties or insurers, arising out of or connected with this contract, and that the Jurisdiction has determined in writing is not subject to Section 1040, 1.10, shall be resolved by arbitration or litigation as elected by the Jurisdiction. As to any such causes of action, Contractor shall provide written notice to Jurisdiction requesting that Jurisdiction make its election as to whether the dispute shall be settled by arbitration or litigation. The written notice shall be either (i) personally delivered, (ii) sent by certified mail, return receipt requested, or (iii) delivered by a nationally recognized prepaid overnight courier service (receipt requested) addressed as follows:

City of Des Moines
Engineering Department
400 Robert D. Ray Drive
Des Moines, IA 50309-1891
Attention: Steve Naber, P.E., City Engineer

Jurisdiction shall notify Contractor in writing as to its election within thirty (30) days of receipt of Contractor’s written notice requesting a determination by Jurisdiction.

1. Arbitration

(a) If the Jurisdiction elects to use binding arbitration for final resolution, the sole and exclusive remedy for final resolution of the dispute shall be binding arbitration (the “Arbitration”). The Arbitration shall be submitted to a single arbitrator as is mutually agreed upon by the Contractor and Jurisdiction. If the Contractor and Jurisdiction cannot agree upon a single arbitrator within twenty-one (21) days of the date of the Jurisdiction’s notification to the Contractor of the Jurisdiction’s decision to pursue binding arbitration, the Arbitration shall be submitted to a three (3) member panel appointed as follows: the Contractor shall appoint one arbitrator; the Jurisdiction shall appoint one arbitrator; and the third arbitrator shall be chosen by the first two appointed arbitrators (for the sake of convenience, the arbitrator, or arbitrators as the case may be, shall be referred to hereinafter as the “Arbitrator”). The parties agree to work toward appointment of a three (3) member Arbitration panel within twenty-one (21) days after not being able to agree on a single arbitrator. The Arbitration shall be conducted in general accord with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect. The parties reserve the right to alter and amend the rules for the Arbitration as they may mutually agree in writing.
(b) Jurisdiction of the Arbitrator shall not extend to setting aside or modifying the terms or requirements of the contract.

(c) Subject to agreement of the parties and the Arbitrator, the parties shall work in good faith to schedule the Arbitration and allow for the decision of the Arbitrator within two hundred forty (240) days after appointment of the Arbitrator.

(d) The Arbitrator shall render a written decision within twenty (20) days after the matter has been fully submitted. For Arbitrations before more than one arbitrator, the decision of a majority of the panel shall govern. The Arbitrator’s decision shall provide a basis for the findings and legal conclusions and shall determine how the cost of the proceedings shall be borne by the parties.

(e) The decision of the Arbitrator shall be binding and final. There shall be no further appeal or judicial review, except under the limited circumstances as allowed by Iowa law.

2. Litigation.

(a) If the Jurisdiction elects not to use arbitration as the means to reach final resolution of the claim or fails to notify Contractor in writing within thirty (30) days of its election, then the sole and exclusive remedy for final resolution of the Claim shall be litigation which must be brought in Iowa District Court in and for the County where the Jurisdiction is located or in the United States District Court in and for the District where the Jurisdiction is located.

(b) To the fullest extent permitted by law, Contractor and Jurisdiction hereto waive any right each may have to a trial by jury in respect of litigation directly or indirectly arising out of or in connection with this Agreement.

B. Contractor further consents that it will require its subrogees and assigns to enter into an agreement to comply with the terms of Section, 1.12, and consent to the jurisdiction of either the Iowa District Court in and for the County where the Jurisdiction is located or the United States District Court in and for the District where the Jurisdiction is located, as to any causes of action brought against it arising out of this contract or any work performed under it by Contractor or its subcontractors, and further agrees, on behalf of itself, its subrogees and assigns, to waive any and all objections to the jurisdiction of said court as to any such cause of action. Contractor shall make such consent a condition of the retention of subrogees and assigns.

1070, 2.10 DUST CONTROL: Add the following paragraph:

The Contractor shall be responsible to remove any project-related construction materials deposited on a public street as well as related dust control measures. The Contractor shall employ all means necessary to prevent tracking soil, or loss of material, onto public streets; including but not limited to, rocking private access roads and removing excess material from equipment before leaving the construction site. The Contractor shall promptly remove any material deposited on a public street utilizing mechanical scraping and street sweeping, or other means as required by the Jurisdictional Engineer.

1070, 3.02 INSURANCE REQUIREMENTS, A.: Delete A and replace them with the following A.

A. The contractor shall not purchase liability insurance in the name of the jurisdiction unless such purchase is allowed by special provision.
1070, 3.02 INSURANCE REQUIREMENTS, C. 2. Commercial General Liability Insurance: Revise the following limits on the Commercial General Liability Insurance:

- The Each Occurrence Limit shall be changed from $1,000,000 to $2,000,000.
- The Personal and Advertising Injury Limit, under Commercial General Liability, changed from $1,000,000 to $2,000,000.
- All other limits shall remain unchanged.

1070, 3.02 INSURANCE REQUIREMENTS, C. 3. Automobile Liability Insurance: Revise the following limits on the Automobile Liability Insurance:

- Minimum combined single limit per accident shall be changed from $1,000,000 to $2,000,000.

1070, 3.02 INSURANCE REQUIREMENTS, C.: Add the following sentence at the end of 1, 2, 3, and 5: “Waiver of Subrogation in favor of Jurisdiction is required.”

1070, 3.02 INSURANCE REQUIREMENTS, C., 6. Additional Insured Endorsements: Replace “Except for Workers Compensation, the insurance specified shall:”, with “Except for Workers Compensation and Railroad Protective Liability Insurance, the insurance specified shall:”.

1070, 3.02 INSURANCE REQUIREMENTS, C: Add the following new 8.

8. WAIVER OF SUBROGATION: To the fullest extent permitted by law, Contractor hereby releases the Jurisdiction, including their respective elected and appointed officials, agents, employees and volunteers and others working on their behalf from and against any and all liability or responsibility to the Contractor or anyone claiming through or under the Contractor by way of subrogation or otherwise, for any loss arising out of liability or occupational injury without regard to the fault of the Jurisdiction or the type of loss involved. This provision shall be applicable and in full force and effect only with respect to loss or damage occurring during the time of this Agreement. The Contractor’s policies of insurance shall contain a clause or endorsement to the effect that such releases shall not adversely affect or impair such policies or prejudice the right of the Contractor to recover thereunder.

1070, 3.03 CONTRACTOR’S INDEMNITY – CONTRACTUAL LIABILITY INSURANCE: Delete B.; and replace with the following B.

B. Except to the extent caused by or resulting from the negligent act or omission of the Jurisdiction or the Jurisdiction’s employees, consultants, agents or other for whom the Jurisdiction is responsible, to the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Jurisdiction and its officers, agents, employees, and consultants from and against all claims, damages, losses, and expenses, including but not limited to, attorney's fees, arising out of or resulting from the performance or prosecution of the work by the Contractor, its subcontractors, agents, or employees; or arising from any neglect, default, or mismanagement or omissions by the Contractor, its subcontractors or consultants, suppliers, third parties, or the agents, officers, or employees of any of them in the performance of any duties imposed by the contract or by law; provided any such claim, damage, loss, or expense:

1. is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including economic damages and the loss of use resulting therefrom, and

2. is caused in whole or in part by any act or omission of the Contractor, its subcontractors or consultants, suppliers, third parties, or the agents, officers, or employees of any of them, or anyone for whose acts any of them may be liable.
Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity that would otherwise exist as to any party or person described in this subsection.

1070, 3.04 CONTRACTORS INSURANCE FOR OTHER LOSSES; WAIVER OF SUBROGATION, B.: Delete B. and replace with the following B.

B. Contractor shall cause each of its subcontractors, consultants, suppliers, third parties, or the agents of any of them, to carry insurance sufficient to cover all loss to such materials, tools, motor vehicles, and equipment. All insurance carried by the Contractor, or its subcontractors, consultants, suppliers, third parties or the agents of any of them, covering risk of loss or damage to materials, tools, motor vehicles, and equipment used in the performance of the Work, shall provide a waiver of subrogation against the Jurisdiction, as specified in Section 1070, 3.02 Insurance Requirements, C.8. To the extent that any subcontractors, consultants, suppliers, third parties or the agents of any of them, do not provide such coverage, any uninsured loss shall be the sole responsibility of the Contractor.

1070, 3.05 PROPERTY INSURANCE: Delete A, D, and M; and replace them with the following A, D, and M.

A. Property Insurance Required: The Contractor shall purchase and maintain property insurance, being either Builder’s Risk Insurance or an Installation Floater, for the period of the contract until final acceptance of the work by the Jurisdiction, on all construction contracts where a building, electrical, mechanical, or plumbing permit is required by the permitting entity.

1. Builder’s Risk Insurance by Contractor: On contracts for construction of new buildings or on contracts when Builder’s Risk Insurance is applicable to the contract by definition, the Contractor shall purchase and maintain Builder’s Risk Insurance for the duration of the contract; unless the Jurisdiction states by special provision that the Jurisdiction shall purchase and maintain the Builder’s Risk Insurance. This property insurance, Builder's Risk Insurance, provided by the Contractor shall be in the amount of the initial bid amount, or in an amount equal to the estimated value of actual building construction, whichever is less, as well as applicable modifications thereto for the entire work at the site on a replacement cost basis. Such property insurance shall be maintained, unless otherwise provided in the contract documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final acceptance of the work by the Jurisdiction. The insurance shall include interests of the Jurisdiction, the Contractor, subcontractors, and sub-subcontractors in the work. If the Contractor’s property insurance covering the work has any deductible, the Contractor shall be responsible to pay the cost associated with the deductible. Flood and Earthquake Insurance shall be required as part of the Builder’s Risk Policy, and the minimum required policy limits shall be not less than 10% of the full amount of the contract. If Boiler and Machinery Insurance is required by the contract documents or by law, the Contractor shall purchase the Boiler and Machinery Insurance if the Contractor is required to purchase the Builder’s Risk Insurance. If Boiler and Machinery Insurance coverage is included in the Contractor’s Builders Risk Insurance policy, it may be used to satisfy the Boiler and Machinery Insurance requirement to the extent such coverage specifically covers such objects during installation, testing, and until final acceptance by the Jurisdiction.

2. Builder’s Risk Insurance by the Jurisdiction: When stated in the special provisions, the Jurisdiction shall purchase and maintain property insurance, a.k.a. Builder's Risk Insurance in the amount of the initial bid amount, or in an amount equal to the estimated value of actual building construction, whichever is less, as well as applicable modifications thereto for the entire work at the site on a replacement cost basis. Such property insurance shall be maintained, unless otherwise provided in the contract documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final acceptance of the work by the Jurisdiction. The insurance shall include interests of the Jurisdiction, the Contractor, subcontractors, and sub-subcontractors in the work. The Jurisdiction will determine an appropriate deductible for the property insurance covering the
work, however, the Contractor will be responsible for paying a deductible of up to $5,000 for each occurrence. Flood and Earthquake Insurance shall be required as part of the Builder’s Risk Policy, and the minimum required policy limits shall be not less than 10% of the full amount of the contract. If Boiler and Machinery Insurance is required by the contract documents or by law, the Jurisdiction shall purchase the Boiler and Machinery Insurance if the Jurisdiction is required to purchase the Builder’s Risk Insurance. If Boiler and Machinery Insurance coverage is included in the Jurisdiction’s Builders Risk Insurance policy, it may be used to satisfy the Boiler and Machinery Insurance requirement to the extent such coverage specifically covers such objects during installation, testing, and until final acceptance by the Jurisdiction.

3. Installation Floater: On the remainder of these contracts where Builder’s Risk Insurance is not applicable to a contract by definition and an Installation Floater is applicable by definition, the Contractor shall purchase and maintain an Installation Floater for the duration of the contract. This Installation Floater shall cover all materials, fixtures, equipment, and supplies provided for the job. Such insurance shall be on an “all risk” form in an amount equal to the maximum value of such materials, equipment, or supplies covered on the job site, off-premises at any temporary storage location, or in transit, and shall include coverage for hoisting and rigging. The Installation Floater shall be maintained until final acceptance of the work by the Jurisdiction. If the Contractor’s Installation Floater covering the equipment and work has any deductible, the Contractor shall be responsible to pay the cost associated with the deductible. If Boiler and Machinery Insurance is required by the contract or by law, the Contractor shall purchase the Boiler and Machinery Insurance; the Installation Floater may be used to satisfy this requirement to the extent the Boiler and Machinery Insurance coverage specifically covers such objects during installation, testing, and until final acceptance by the Jurisdiction.

D. Boiler and Machinery Insurance: When required by the contract documents or by law, Boiler and Machinery Insurance shall specifically cover such insured objects during installation, testing, and until final acceptance by the Jurisdiction; this insurance shall include interest of the Jurisdiction, Contractor, subcontractors, and sub-subcontractors in the work, and the Jurisdiction and Contractor shall be named insureds. A Builders Risk Insurance policy or an Installation Floater, when also required by the contract documents or by law, may satisfy this requirement as indicated in 1070, 3.05 A.1, 2, and 3. above. If Boiler and Machinery Insurance is required by the contract documents or by law, the Contractor shall purchase the Boiler and Machinery Insurance. However, if the contract, requires the Jurisdiction to purchase the Builder’s Risk Insurance, the Jurisdiction shall also purchase the Boiler and Machinery Insurance.

M. Installation Floater: See Section 1070, 3.05, A.3 above.

1070, 3.06 ENDORSEMENT NAMING JURISDICTION AS AN ADDITIONAL INSURED / CANCELLATION AND MATERIAL CHANGE / GOVERNMENTAL IMMUNITIES ENDORSEMENT: Under C, delete the first full paragraph regarding the Cancelation and Material Change Endorsement language and replace it with the following:

Thirty (30) days Advance Written Notice of Cancellation, ten (10) days Written Notification of Cancellation due to non-payment of premium and forty-five (45) days Advance Written Notification of Non-Renewal shall be sent to the Jurisdiction at the office and attention of the Certificate Holder. This endorsement supersedes the standard cancellation statement on the Certificate of Insurance to which this endorsement is attached.
1070, 3.06 ENDORSEMENT NAMING JURISDICTION AS AN ADDITIONAL INSURED / CANCELLATION AND MATERIAL CHANGE/ GOVERNMENTAL IMMUNITIES

ENDORSEMENT: Replace first sentence under E. with the following: If allowed, as specified in Section 1070, 3.02 Insurance Requirements A., all liability policies purchased in the Jurisdiction’s name shall include a Governmental Immunities Endorsement, pursuant to Iowa Code Section 670.4, which endorsement shall include the following provisions:

1070, 3.07 PROOF OF INSURANCE: Add the following sentence at the end of A: “Mail Certificate of Insurance to: Engineering Department, City of Des Moines, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa 50309.”

SECTION 1080 – PROSECUTION AND PROGRESS

1080, 1.03 WORK PROGRESS AND SCHEDULE: Add the following new D:

D. No person shall operate or permit the operation of any tools or equipment in construction, drilling or demolition work or in preventive maintenance work for public service utilities between the hours of 10:00 p.m. and 7:00 a.m. without the written permission of the Engineer.

1080, 1.09 EXTENSION OF TIME, B. – Request for Extension of Time: Add the following sentence before the last sentence in the first paragraph: “The request for an extension of time is the sole and exclusive remedy of the Contractor for the events listed below.

SECTION 1090 – MEASUREMENT AND PAYMENT

1090, 1.02 SCOPE OF PAYMENT, Add the following D.

D. If the Contractor fails to notify the Engineer or the Engineers representative prior to commencing work on various stages of work on the project, the work completed without notifying the City may not be compensated.

1090, 1.04 PAYMENT FOR CHANGE ORDERS, C.: Replace with the following:

C. The percentage markup to be allowed to the Contractor for extra work performed by a subcontractor shall include all overhead, profit, bond, and all subcontractor markups for changes in work and shall be in accordance with the following:

1. 10% of the first $50,000 with a $100 minimum.
   5% of the portion over $50,000.

To include the markup on the change order, the Contractor shall, at the request of the Engineer, furnish evidence satisfactory to the Engineer of the cost (rate or rates) paid for such bond, insurance, and tax. This may include, at the request of the Engineer, a bond rider for the performance bond.

1090, 1.05 PROGRESS PAYMENTS, B. Retainage: Delete B. in its entirety and replace with the following B.

B. Retainage: The Jurisdiction shall retain from each monthly progress payment 3% of the amount determined to be due according to the estimate of the Engineer. Early release of retained funds may be requested by the Contractor according to Iowa Code Section 573.28.
SECTION 2010 – EARTHWORK, SUBGRADE, AND SUBBASE

2010, 3.06 SUBGRADE PREPARATION, A. Uniform Composition: 1. Subgrade Compaction in Fill Sections: Add the following new e.

e. Proof roll subgrade as specified in Section 3.06, B. to locate soft or yielding areas prior to placement of top six-inch lift.

2010, 3.06 SUBGRADE PREPARATION, A. Uniform Composition: 2. Subgrade Compaction in Cut Sections: Add the following new d.

d. Prior to scarify, mix, and re-compact the bottom six inches of subgrade (paragraph 2.b above), proof roll subgrade as specified in Section 3.06, B to locate soft or yielding areas.

2010, 3.07 SUBGRADE TREATMENT, A. Lime, Cement, Fly Ash, or Asphalt: Add the following new 3.

3. The Contractor shall comply with the following conditions when incorporating the subgrade treatments.

a. The Contractor shall not begin stabilization work if the following weather conditions are to happen within 24 hours after stabilization:

   Temperature expected to drop below 40°F within the first 24 hours of incorporation unless approved by the Engineer.
   Rain.
   Wind speeds of 15 mph or greater unless approved by the Engineer prior to stabilization work.

b. The subgrade treatment shall not be incorporated into frozen subgrade conditions.

c. The deviation from target range will not exceed 0.5% ± the approved mix design rate.

d. Contractor shall use a reclaimer machine with computerized water proportioning system that measures and applies the water directly into the mixing chamber when the machine is in motion. The treatment chemicals will be distributed via computerized vane feeder on the subgrade prior to mixing to minimize loss of treatment chemicals as dust. Dumping or blowing of treatment chemicals onto the subgrade will not be allowed.

e. During the compaction operation, no section shall be left undisturbed for longer than 30 minutes during compaction operations.

SECTION 3010 – TRENCH EXCAVATION AND BACKFILL

3010, 3.02 ROCK OR UNSTABLE SOILS IN TRENCH BOTTOM: Delete B. and replace with the following new B.

B. The Engineer will review the contractor’s request for the need for over-excavation and trench foundation stabilization and authorize the work prior to installation of pipes and structures.
3010, 3.05 PIPE BEDDING AND BACKFILL, E. Final Trench Backfill: 3. Class I and Class II Backfill Material: Delete a. and replace with the following new a.

a. Compact to at least 65% relative density within right-of-way or under any paved surface or within two feet thereof.

3010, 3.05 PIPE BEDDING AND BACKFILL, E. Final Trench Backfill: 4. Class III and Class IVA Backfill Material: Delete a. and replace with the following new a.

a. Compact to at least 95% of Standard Proctor Density within right-of-way or under any paved surface or within two feet thereof.

SECTION 4010 – SANITARY SEWERS

4010, 3.06 SANITARY SEWER SERVICE STUBS, C: Add the following new 7:

7. Mark the location of all sanitary sewer service stubs at the time of installation by a two-inch wide detectable marking tape installed at a depth of 18 inches to 24 inches below finished grade, directly over the service stub, for its entire length and brought up to the surface at the end of the service stub adjacent to the post marking the stub location. The tape shall be green in color and marked “Sanitary Sewer Service Stub Buried Below”.

4010, 3.10 SANITARY SEWER CLEANOUT: Delete in its entirety and replace with the following:

Cleanouts are not allowed on sanitary sewer mains in the City of Des Moines. Figure 4010.203 shall apply to services only.

SECTION 4020 – STORM SEWERS

4020, 2.01 STORM SEWERS, Parts A-L: Reinforced Concrete Pipe or Polypropylene Pipe shall be required for storm sewer construction in the Right-Of-Way or Public Easement areas. Minimum size of storm sewer pipe in the Right-Of-Way and Public Easement areas shall be 15-inch minimum diameter.

SECTION 4030 – PIPE CULVERTS

4030, 2.01 Pipe Culverts, Parts A-D: Reinforced Concrete Pipe shall be required for pipe culvert construction in the Right-Of-Way or Public Easement areas. Minimum size of pipe culverts in the Right-Of-Way and Public Easement areas shall be 15-inch minimum diameter.

SECTION 4040 – SUBDRAINS AND FOOTING DRAIN COLLECTORS

4040, 2.01 FOOTING DRAIN COLLECTORS: Use material for pipe and fittings complying with the current Adopted Edition of the Uniform Plumbing Code (UPC). In addition to the materials identified in the UPC, the pipe shall comply with ASTM D 3034, SDR 23.5 pipe will be allowed.

4040, 2.02 TYPE 1 SUBDRAINS (LONGITUDINAL SUBDRAIN), C. Corrugated Polyethylene Tubing and Fittings (Corrugated PE): Delete Type C and Type CP. Only Type S or Type SP are allowed in the City of Des Moines.

4040, 2.03 TYPE 2 SUBDRAINS (COMBINATION SUBDRAIN/FOOTING DRAIN COLLECTOR), B.3. HDPE Pipe: Delete Type CP. Only Type SP is allowed in the City of Des Moines.
4040, 2.09 **FOOTING DRAIN SERVICE STUBS** - Add this new 2.09 and the following note: Use material for pipe and fittings complying with the current Adopted Edition of the Uniform Plumbing Code (UPC). In addition to the materials identified in the UPC, the use of SDR 23.5 pipe will be allowed.

4040, 3.02 **FOOTING DRAIN COLLECTORS, C:** Add the following new 3:

3. Type B cleanouts should be used for footing drain collectors less than 5 feet in depth in the City of Des Moines. Footing drain collectors greater than 5 feet deep, a Type A cleanout shall be used.

4040, 3.03 **FOOTING DRAIN SERVICE STUBS:** Add the following new D and E.

D. Mark the location of all footing drain service stubs at the time of installation by a two-inch wide detectable marking tape installed at a depth of 18 inches to 24 inches below finished grade, directly over the service stub, for its entire length and brought up to the surface at the end of the service stub adjacent to the post marking the stub location. The tape shall be green in color and marked “Footing Drain Service Stub Buried Below”.

E. ABS, PVC and SDR 23.5 pipe shall be installed with a minimum bedding of 4” below and up all side with 3/8” clean smooth gravel or a bedding product approved by the Engineer.

4040, **FIGURE 4040.232, SUBDRAIN CLEANOUTS:** Add the following new Note 7 to Figure 4040.232.

7. Type B cleanouts should be used for footing drain collectors or combination subdrain/footing drain collectors less than 5 feet in depth in the City of Des Moines. Footing drain collectors greater than 5 feet deep, a Type A cleanout shall be used.

**SECTION 4060 – CLEANING, INSPECTION, AND TESTING OF SEWERS**

4060, 3.03 **VIDEO INSPECTION, A. General:** Delete 1. and replace with the following new 1.

1. Conduct video inspection of all new and rehabilitated sanitary sewers, storm sewers, pipe culverts, and footing drain collectors after all backfill and compaction operations are completed, but prior to paving, unless otherwise specified in the contract documents.

**SECTION 6010 – STRUCTURES FOR SANITARY AND STORM SEwers**

6010, **PARTS 1, 2, 3, and Figures:** Unless specifically noted as precast construction on the construction drawings, all square or rectangular shaped intakes and manholes shall be cast-in-place. Circular precast intakes and manholes are allowed in the City of Des Moines.

6010, **2.03, B. REINFORCEMENT:** Add the following second sentence: All reinforcement for cast-in-place structures shall be epoxy coated.

6010, **2.09 MANHOLE OR INTAKE ADJUSTMENT RINGS (Grade Rings):** Add the following new C.

C. Manhole adjustment rings are not required to have pre-formed or pre-drilled holes for the anchor bolts.

6010, **2.10 CASTINGS (Ring, Cover, Grate, and Extensions), D. Casting Types: 2. - Intakes:** Delete b. and replace it with the following b.

b. Castings shall include design shown in this General Supplemental for lids on Type E, F, and G storm sewer castings shown for Figure 6101.602. The casting design is shown in the figure titled Storm Sewer Lid For the City of Des Moines.
6010, 2.13 STEPS: Delete entire Section as manhole steps are not allowed in the City of Des Moines.

6010, 2.15 ANCHOR BOLTS AND WASHERS, B. Diameter: Delete B. and replace it with the following B.: Provide bolts and washers 1/8 inch smaller than hole or slot in the casting frame but not less than 7/8 inch diameter.

6010, 3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES, J. Castings: Delete J. and replace with the following J.: Install the type of casting specified in the contract documents and adjust to proper grade. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface. When castings with a bolt down cover (Type C or D) are specified, attach casting frame to the structure with four anchor bolts.

6010, 3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES, Add new F. following:

F. Field Modification of Precast Structures: Significant modifications to precast structures to adjust elevations to field conditions will not be allowed. Significant modifications include, but are not limited to, excessive saw cutting of precast structures. Any field modifications to the precast structure shall be approved by the Engineer, or the Engineer’s representative, or the precast structure will not be accepted.

SECTION 7010 – PORTLAND CEMENT CONCRETE PAVEMENT

7010, 1.08 MEASUREMENT AND PAYMENT, Add new N. following:

N. Cold Weather Protection: When any type of additional protection described in 7010.3.04.A is necessary, additional payment will be made as extra work at the rate of $1.00 per square yard of surface protected. Payment will be limited to protection within the contract period. Protection necessary after November 15 will be paid only when the Engineer authorizes the work.

7010, 3.01 EQUIPMENT, A. Batching and Mixing Equipment, 2. Batching, Add new d. following:

d. Volumetric batching for Portland Cement Concrete will not be allowed unless authorized by the Engineer.

7010, 3.01 EQUIPMENT, C. Concrete Placement Equipment, 7. Concrete Saws, Add the following new 1:

1. Saw cutting operations shall be dustless in accordance with OSHA regulations.

7010, 3.02 PAVEMENT CONSTRUCTION, E. Bar and Reinforcement Placement: Add the following new 5:

5. PCC pavement slabs with manhole castings, with or without boxouts, shall have reinforcement similar to PV-103 around the castings.

7010, 3.07 QUALITY CONTROL, D. Pavement Thickness: Add the following as the first sentences under 1: Coring of pavement will not be required by the City of Des Moines if depth checks of the plastic thickness of the pavement are within one-half inch of the design thickness. If the variance exceeds one-half inch this section shall apply.

7010, FIGURE 7010.101, JOINTS: On Sheet 2 of 8 under ‘C’ Joint in Curb add the following: The entire curb shall be sealed with Joint Sealant Material.
7010, FIGURE 7010.101, JOINTS: On Sheet 3 of 8 delete Note 11 and replace with the following Note 11.

11. Sawing and sealing of the joint is required. See Detail D-2. On Sheet 3 of 8 Joint Types KT-1, KT-2, and KT-3 shall not be used.

7010, FIGURE 7010.901, PCC PAVEMENT JOINTING: Add Note 6 with the following:

6. All new roadway pavements shall be a minimum width of 27 feet back to back with parking on one side and 33 feet with parking on two sides.

SECTION 7020 – HOT MIX ASPHALT PAVEMENT

7020, 3.01 HMA PAVEMENT, Add the following new H.:

H. The paver shall be capable of paving a minimum continuous width of twenty (20) foot wide strip without seam. Pavers in tandem will be acceptable; however, an adequate number of personnel shall be available to operate both pavers simultaneously.

7020, FIGURE 7020.901, HMA PAVEMENT: Add Note 3 with the following:

3. All new roadway pavements shall be a minimum width of 27 feet back to back with parking on one side and 33 feet with parking on two sides.

SECTION 7021 – HOT MIX ASPHALT OVERLAYS

7020, 3.01 HMA PAVEMENT, Add the following new C.:

C. The paver shall be capable of paving a minimum continuous width of twenty (20) foot wide strip without seam. Pavers in tandem will be acceptable; however, an adequate number of personnel shall be available to operate both pavers simultaneously.

SECTION 7030 – SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS

7030, 1.08 MEASUREMENT AND PAYMENT, Add new J. following:

J. Cold Weather Protection: When any type of additional protection described in 7010.3.04.A is necessary, additional payment will be made as extra work at the rate of $1.00 per square yard of surface protected. Payment will be limited to protection within the contract period. Protection necessary after November 15 will be paid only when the Engineer authorizes the work.

7030, 2.07 DETECTABLE WARNINGS: Add the following sentence at the end: Only cast iron detectable warnings are allowed in the City of Des Moines.

7030, 3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS, A. Form Setting: Add the following new 6:

6. The turning space for a sidewalk or shared use path shall be formed separately from the adjoining ramps and sidewalk or shared use path.
7030, 3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS, B. Concrete Pavement Placement, 1. Shared Use Path: Add the following sentence at the end: “When the Portland Cement Concrete is delivered to the project on the prepared subgrade or subbase, the loads shall be limited to 5 tons for single axle vehicles or 10 tons for tandem axle or larger vehicles.”

Add the following new 4:

4. Volumetric batching for Portland Cement Concrete will not be allowed unless authorized by the Engineer.

7030, 3.04 PCC, SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS, B. Concrete Pavement Placement, 2. Sidewalk: Add the following new g:

g. The turning space for a sidewalk or shared use path shall be placed separately from the adjoining ramps and sidewalk or shared use path.

7030, 3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS, F. Jointing: 4. Isolation Joints: Delete b. and replace it with the following new b.

b. For a sidewalk constructed with a driveway, install a ½” expansion joint on the property side of the sidewalk and a ½” expansion joint on the street side of the sidewalk.

7030, 3.05 HMA SHARED USE PATHS AND DRIVEWAYS: Add the following second sentence: When Hot Mix Asphalt is delivered to the project on the prepared subgrade or subbase, the loads shall be limited to 5 tons for single axle vehicles or 10 tons for tandem axle or larger vehicles.

7030, FIGURE 7030.101, CONCRETE DRIVEWAY, TYPE A: Delete the references to “E Joint” on the property side of the sidewalk and “C or E Joint” on the street side of the sidewalk, and replace with “install a ½” expansion joint on the property side of the sidewalk and a ½” expansion joint on the street side of the sidewalk”. In addition, install a ½” expansion joint in the sidewalk at the extension of both edges of the driveway. Delete 7 and replace with the following 7; “Install a ½” expansion joint at the back of curb.”

7030, FIGURE 7030.102, CONCRETE DRIVEWAY, TYPE B: Delete the references to “E Joint” on the property side of the sidewalk and “C or E Joint” on the street side of the sidewalk, and replace with “install a ½” expansion joint on the property side of the sidewalk and a ½” expansion joint on the street side of the sidewalk”. In addition, install a ½” expansion joint in the sidewalk at the extension of both edges of the driveway.

7030, FIGURE 7030.201, CLASSES OF SIDEWALKS: The detail for CLASS A SIDEWALK shall be revised to delete the “4” min.” thickness dimension of the sidewalk and replace with “5” min.”.

7030, FIGURE 7030.202, CURB DETAILS FOR CLASS A SIDEWALK: On Detail 3 delete the note “Sealed ‘E’ joint” and replace it with the following note “Sealed ‘B’ joint”. On Detail 1, 2, and 3 delete the “4 min.” thickness dimension of the sidewalk and replace with “5” min.”.

SECTION 8030 – TEMPORARY TRAFFIC CONTROL

8030, Add new 3.04.A – Traffic Control Deficiency Deduction

A. Traffic Control Deficiency Deduction. When the Engineer is notified, or determines a traffic control deficiency exists, he/she will notify and direct the Contractor to correct the deficiency within a specified time. The specified time, which begins upon notification to the Contractor, will be from ½ hour to 12 hours based upon the urgency of the situation and nature of the deficiency as determined by the Engineer.
A traffic control deficiency may be any lack of repair, maintenance, or non-compliance with the traffic control plan. A traffic control deficiency may also be applied to situations where corrective action is not an option such as the use of non-certified flaggers for short term operations; working with lane closures beyond the time allowed in the contract; or failure to perform required contract obligations such as traffic control surveillance.

If a Contractor fails to correct a traffic control deficiency within the specified time, a daily monetary deduction from the pay item for Traffic Control will be imposed for each calendar day or fraction thereof the deficiency exists. The calendar days(s) will begin with the notification to the Contractor and end with the Engineer’s acceptance of the correction. The daily monetary deduction will be $2,500. For those deficiencies where corrective action was not an option, this monetary deduction will be immediate.

SECTION 9010 – SEEDING

9010, 3.02 – AREA OF SEEDING:  Add A. and B.

A. Mobilize within 72 hours of a written order with sufficient labor, equipment, and materials to seeding work as ordered or approved by Engineer. Complete work within 7 calendar days of a written order.

B. Failure to mobilize and complete work within such time period, will result in a deduction of $750.00 per calendar day from payment due under the contract, except when Engineer extends such time period.

SECTION 9020 – SODDING

9020, 3.03 – SOD INSTALLATION:  Delete A. and replace it with the following new A.

A. Do not install sod between the dates of June 1 and August 31, unless authorized by the Engineer.

B. Mobilize within 72 hours of a written order with sufficient labor, equipment, and materials to sod installation as ordered or approved by Engineer. Complete work within 7 calendar days of a written order.

C. Failure to mobilize and complete work within such time period, will result in a deduction of $750.00 per calendar day from payment due under the contract, except when Engineer extends such time period.

SECTION 9040 – EROSION AND SEDIMENT CONTROL

9040, 1.03 – SUBMITTALS:  Add the following sentences:  The Jurisdiction will not approve the contractor’s Stormwater Pollution Prevention Plan (SWPPP) or revisions to the SWPPP; instead, the Jurisdiction will only review and comment on the SWPPP and any revisions. The contractor shall submit to the Engineer a copy of the Iowa Department of Natural Resources authorization prior to the Jurisdiction’s issuance of the Notice to Proceed for the work.

9040, 1.08 – MEASUREMENT FOR PAYMENT, A. Stormwater Pollution Prevention Plan (SWPPP):  Delete A. in its entirety and replace with the following A.

A. Stormwater Pollution Prevention:  Item will be paid for as a lump sum for the project based on the following formula: 30% of the bid amount after review of the SWPPP by the Engineer and filing a Notice of Intent by the contractor, an additional 20% of the bid amount when 25% of the total original contract amount is earned, an additional 20% of the bid amount when 50% of the total original contract amount is earned, an additional 20% of the bid amount when 75% of the total original contract amount is earned, and the remaining 10% of the bid amount upon filing the Notice of Discontinuation by the contractor. Item shall include the following activities and work:

1. Stormwater Pollution Prevention Plan (SWPPP) Preparation:  Item includes reviewing and preparation of any modifications necessary to the general SWPPP provided by the Jurisdiction based on the Contractor’s proposed scheduling and construction methods, filing a Notice of Intent for coverage of the project under the Iowa DNR NPDES General Permit No. 2, and
payment of associated NPDES permit fees. The Jurisdiction will publish the Public Notice of Storm Water Discharge and provide an affidavit of publication to the contractor.

2. **Management:** Item includes all work required to comply with the administrative provisions of the Iowa DNR NPDES General Permit No. 2; including record keeping, documentation, updating the SWPPP, filing the Notice of Discontinuation, etc. Item also includes weekly inspections required to satisfy the provisions of General Permit No. 2, unless otherwise stated in the contract documents.

3. **Inspection:** Item includes inspection of the disturbed areas, and erosion and sediment control measures performed by the contractor, at least once every seven (7) calendar days until the disturbed areas have been stabilized with a perennial vegetative cover of sufficient density to preclude erosion.

4. **Additional Erosion and Sediment Control Measures:** Item includes the cost of erosion and sediment control measures included in the contractor’s modifications to the general SWPPP provided by the Jurisdiction that are either not included as bid items on the proposal or exceed 20% of the proposal unit quantity for the measure, as well as replacement of these measures if needed. The contractor will be paid at the unit bid price for additional erosion and sediment control measures constructed that are included in the contractor’s modifications to the general SWPPP provided by the Jurisdiction when the quantity of these additional measures is less than or equal to 20% of the contract quantity for the measure.

**9040, 3.01 – SWPPP PREPARATION:** Delete in its entirety and replace with the following.

A. Review and prepare any modifications necessary to the general SWPPP provided by the Jurisdiction based on the Contractor’s proposed scheduling and construction methods. Prepare a Stormwater Pollution Prevention Plan (SWPPP) according to the requirements of the Iowa DNR NPDES General Permit No. 2.

B. Have the SWPPP prepared by an individual experienced in erosion and sediment control.

C. Ensure that controls utilized in the SWPPP conform to the type and quantity of erosion and sediment controls shown in the contract documents. See 9040, 1.08, 4 above for measurement for payment of any erosion and sediment control measure used that is not shown in the contract documents or exceeds 20% of the contract quantity for the measure.

D. Submit the completed SWPPP to the Engineer for review and comment prior to filing the Notice of Intent.

E. The Jurisdiction will publish the Public Notice of Storm Water Discharge, as required by the NPDES General Permit No. 2 and provide an affidavit of publication to the contractor.

F. File the Notice of Intent and fee, as required by the NPDES General Permit No. 2.

G. Prior to beginning grading, excavation, or clearing and grubbing operations, all erosion and sediment control measures identified in the SWPPP shall be installed or constructed.

**9040, 3.02 – SWPPP MANAGEMENT:** Delete C. in its entirety and replace with the following C.

C. Submit all SWPPP revisions to the Engineer for review and comment.

**SECTION 9080 – CONCRETE STEPS AND HANDRAIL**

**9080, 2.01 – MATERIALS, B. Reinforcing Steel:** Add the following sentence at the end: “All reinforcement shall be epoxy coated.”
LID SHALL BE USED FOR TYPE E, F, AND G APPLICATIONS AS REFERENCED BY SUDAS FIGURE 6010.602.

RAISED LETTERS Flush WITH TOP SURFACE

PICKHOLES

RAISED LETTERS Flush WITH TOP SURFACE

LETTERED "USA" OR "MADE IN USA"

MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
FINISH: NO PAINT

STORM SEWER LID
FOR THE CITY OF DES MOINES, IOWA

General Supplemental Specifications to the SUDAS Standard Specifications, 2022 Edition