

PUBLIC IMPROVEMENT REQUEST FOR PROPOSAL

RFP# 23-50

Ultraviolet (UV) Disinfection System Replacement Project

City of Ann Arbor
Public Services/Water Resource Recovery Facility



Due Date: OCTOBER 17, 2023 by 11:00 a.m. (local time)

Issued By:

City of Ann Arbor
Procurement Unit
301 E. Huron Street
Ann Arbor, MI 48104

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SECTION I - GENERAL INFORMATION

A. OBJECTIVE

The purpose of this Request for Proposal (RFP) is to select a firm to provide construction services to complete work at the Water Resource Recovery Facility (WRRF) to replace the existing ultraviolet (UV) disinfection system, associated electrical, instrumentation and control equipment, and all related components, as well replace the UV channel slide gates, and construct a building to enclose the UV disinfection system.

Work will also include structural modifications to the existing UV channels to accommodate the new system. The existing canopy over the UV Area will be removed and a new enclosed Building will be erected. Work will include integration of control system for the equipment with Ann Arbor's Process Information and Control System. This specification covers the furnishing of all labor and equipment necessary to perform all work.

In a previous phase, the City preselected the UV system supplier (UVSS) through a Request for Proposal (RFP) process and an agreement was executed between the City of Ann Arbor and the selected UVSS, Trojan Technologies, on the scope of work for the UV, electrical and instrumentation and control equipment to be provided. The agreement included shop drawing development, design services, and secured the equipment price indicated in the bid form. Trojan Technologies final accepted shop drawings and proposal bid form, which also indicates their Scope of Services, is included in Appendix 1 of the Technical Specification Section 46 66 56.

The Construction contract executed with the successful bidder through this RFP 23-50 will require issuing of a Purchase Order to the UVSS for the Balance of Work defined in RFP 23-13, and as described herein:

- i. Balance of Work shall consist of all costs for providing goods and services described in RFP 23-13, other than work identified as Early Work, including, but not limited to the following:
 - a. Furnish gates as outlined in the *Open-Channel Metal Slide Gates and Weir Gates* Section.
 - b. Completion of other Division 40 and 46 sections
 - c. Delivery of equipment to site
 - d. Installation and startup assistance
 - e. Training
 - f. Equipment warranty

B. BID SECURITY

Each bid must be accompanied by a certified check or Bid Bond by a surety licensed and authorized to do business within the State of Michigan, in the amount of 5% of the total of the bid price.

Proposals that fail to provide a bid security upon proposal opening will be deemed non-responsive and will not be considered for award.

C. QUESTIONS AND CLARIFICATIONS / DESIGNATED CITY CONTACTS

All questions regarding this Request for Proposal (RFP) shall be submitted via e-mail. Questions will be accepted and answered in accordance with the terms and conditions of this RFP.

All questions shall be submitted on or before September 25, 2023 at 5:00 p.m. (local time), and should be addressed as follows:

Scope of Work/Proposal Content questions shall be e-mailed to Anne Warrow, PE, Plant Utilities Engineer, AWarrow@a2gov.org

RFP Process and Compliance questions shall be e-mailed to Colin Spencer, Buyer - CSpencer@a2gov.org

Should any prospective bidder be in doubt as to the true meaning of any portion of this RFP, or should the prospective bidder find any ambiguity, inconsistency, or omission therein, the prospective bidder shall make a written request for an official interpretation or correction by the due date for questions above.

All interpretations, corrections, or additions to this RFP will be made only as an official addendum that will be posted to a2gov.org and MITN.info and it shall be the prospective bidder's responsibility to ensure they have received all addenda before submitting a proposal. Any addendum issued by the City shall become part of the RFP, and must be incorporated in the proposal where applicable.

D. PRE-PROPOSAL MEETING

A **mandatory** pre-proposal conference for this project will be held on **Tuesday, September 19 at 11:00am at the Water Resource Recovery Facility (WRRF) Administration Building, located at 49 S. Dixboro Rd, Ann Arbor, MI 48105.**

Failure to attend the meeting and sign the RFP sign-in sheet at the pre-proposal meeting will automatically disqualify a bidder from submitting a valid proposal. Any proposal submitted by a party not attending and signing the roster at the pre-proposal meeting will not be opened or considered. Administrative and technical questions regarding this project will be answered at this time. The pre-proposal

meeting is for information only. Any answers furnished will not be official until verified in writing by the Financial Service Area, Procurement Unit. Answers that change or substantially clarify the proposal will be affirmed in an addendum.

E. PROPOSAL FORMAT

To be considered, each firm must submit a response to this RFP using the format provided in Section III. No other distribution of proposals is to be made by the prospective bidder. An official authorized to bind the bidder to its provisions must sign the proposal. Each proposal must remain valid for at least one hundred and twenty (120) days from the due date of this RFP.

Proposals should be prepared simply and economically providing a straightforward, concise description of the bidder's ability to meet the requirements of the RFP. No erasures are permitted. Mistakes may be crossed out and corrected and must be initialed in ink by the person signing the proposal.

F. SELECTION CRITERIA

Responses to this RFP will be evaluated using a point system as shown in Section III. A selection committee comprised primarily of staff from the City will complete the evaluation.

If interviews are desired by the City, the selected firms will be given the opportunity to discuss their proposal, qualifications, past experience, and their fee proposal in more detail. The City further reserves the right to interview the key personnel assigned by the selected bidder to this project.

All proposals submitted may be subject to clarifications and further negotiation. All agreements resulting from negotiations that differ from what is represented within the RFP or in the proposal response shall be documented and included as part of the final contract.

G. SEALED PROPOSAL SUBMISSION

All proposals are due and must be delivered to the City on or before October 17, 2023 by 11:00a.m. (local time). Proposals submitted late or via oral, telephonic, telegraphic, electronic mail or facsimile **will not** be considered or accepted.

Each respondent should submit in a sealed envelope

- **one (1) original proposal**
- **two (2) additional proposal copy**

Proposals submitted should be clearly marked: **“RFP No. 23-50 – Ultraviolet (UV) Disinfection System Replacement Project”** and list the bidder's name and address.

Proposals must be addressed and delivered to:
City of Ann Arbor
c/o Customer Service
301 East Huron Street
Ann Arbor, MI 48107

All proposals received on or before the due date will be publicly opened and recorded on the due date. No immediate decisions will be rendered.

Hand delivered proposals may be dropped off in the Purchasing drop box located in the Ann Street (north) vestibule/entrance of City Hall which is open to the public Monday through Friday from 8am to 5pm (except holidays). The City will not be liable to any prospective bidder for any unforeseen circumstances, delivery, or postal delays. Postmarking on the due date will not substitute for receipt of the proposal.

Bidders are responsible for submission of their proposal. Additional time will not be granted to a single prospective bidder. However, additional time may be granted to all prospective bidders at the discretion of the City.

A proposal may be disqualified if the following required forms are not included with the proposal:

- **Attachment D - Prevailing Wage Declaration of Compliance**
- **Attachment E - Living Wage Declaration of Compliance**
- **Attachment G - Vendor Conflict of Interest Disclosure Form**
- **Attachment H - Non-Discrimination Declaration of Compliance**

Proposals that fail to provide these forms listed above upon proposal opening may be deemed non-responsive and may not be considered for award.

H. DISCLOSURES

Under the Freedom of Information Act (Public Act 442), the City is obligated to permit review of its files, if requested by others. All information in a proposal is subject to disclosure under this provision. This act also provides for a complete disclosure of contracts and attachments thereto.

I. TYPE OF CONTRACT

A sample of the Construction Agreement is included as Attachment A. Those who wish to submit a proposal to the City are required to review this sample agreement carefully. **The City will not entertain changes to its Construction Agreement.**

For all construction work, the respondent must further adhere to the City of Ann Arbor General Conditions. The General Conditions are included herein. Retainage will be

held as necessary based on individual tasks and not on the total contract value. The Contractor shall provide the required bonds included in the Contract Documents for the duration of the Contract.

The City reserves the right to award the total proposal, to reject any or all proposals in whole or in part, and to waive any informality or technical defects if, in the City's sole judgment, the best interests of the City will be so served.

This RFP and the selected bidder's response thereto, shall constitute the basis of the scope of services in the contract by reference.

J. NONDISCRIMINATION

All bidders proposing to do business with the City shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the Section 9:158 of the Ann Arbor City Code. Breach of the obligation not to discriminate as outlined in Attachment G shall be a material breach of the contract. Contractors are required to post a copy of Ann Arbor's Non-Discrimination Ordinance attached at all work locations where its employees provide services under a contract with the City.

K. WAGE REQUIREMENTS

The Attachments provided herein outline the requirements for payment of prevailing wages or of a "living wage" to employees providing service to the City under this contract. The successful bidder must comply with all applicable requirements and provide documentary proof of compliance when requested.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. Use of Michigan Department of Transportation Prevailing Wage Forms (sample attached hereto) or a City-approved equivalent will be required along with wage rate interviews.

For laborers whose wage level are subject to federal, state and/or local prevailing wage law the appropriate Davis-Bacon wage rate classification is identified based upon the work including within this contract. **The wage determination(s) current on the date 10 days before proposals are due shall apply to this contract.** The U.S. Department of Labor (DOL) has provided explanations to assist with classification in the following resource link: www.wdol.gov.

For the purposes of this RFP the Construction Type of Building will apply. The relevant wage determination is included in the Attachment J.

L. CONFLICT OF INTEREST DISCLOSURE

The City of Ann Arbor Purchasing Policy requires that the consultant complete a Conflict of Interest Disclosure form. A contract may not be awarded to the selected bidder unless and until the Procurement Unit and the City Administrator have reviewed the Disclosure form and determined that no conflict exists under applicable federal, state, or local law or administrative regulation. Not every relationship or situation disclosed on the Disclosure Form may be a disqualifying conflict. Depending on applicable law and regulations, some contracts may awarded on the recommendation of the City Administrator after full disclosure, where such action is allowed by law, if demonstrated competitive pricing exists and/or it is determined the award is in the best interest of the City. A copy of the Conflict of Interest Disclosure Form is attached.

M. COST LIABILITY

The City of Ann Arbor assumes no responsibility or liability for costs incurred by the bidder prior to the execution of an Agreement. The liability of the City is limited to the terms and conditions outlined in the Agreement. By submitting a proposal, bidder agrees to bear all costs incurred or related to the preparation, submission, and selection process for the proposal.

N. DEBARMENT

Submission of a proposal in response to this RFP is certification that the Respondent is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal departments or agency. Submission is also agreement that the City will be notified of any changes in this status.

O. PROPOSAL PROTEST

All proposal protests must be in writing and filed with the Purchasing Manager within five (5) business days of any notices of intent, including, but not exclusively, divisions on prequalification of bidders, shortlisting of bidders, or a notice of intent to award. Only bidders who responded to the solicitation may file a bid protest. The bidder must clearly state the reasons for the protest. If any bidder contacts a City Service Area/Unit and indicates a desire to protest an award, the Service Area/Unit shall refer the bidder to the Purchasing Manager. The Purchasing Manager will provide the bidder with the appropriate instructions for filing the protest. The protest shall be reviewed by the City Administrator or designee, whose decision shall be final.

Any inquiries or requests regarding this procurement should be only submitted in writing to the Designated City Contacts provided herein. Attempts by the bidder to initiate contact with anyone other than the Designated City Contacts provided herein that the bidder believes can influence the procurement decision, e.g., Elected Officials,

City Administrator, Selection Committee Members, Appointed Committee Members, etc., may lead to immediate elimination from further consideration.

P. SCHEDULE

The following is the schedule for this RFP process.

| Activity/Event | Anticipated Date |
|--------------------------------------|---|
| Pre-Proposal Conference | September 19, 2023, 11:00 a.m. (Local Time) |
| Written Question Deadline | September 25, 2023, 5:00 p.m. (Local Time) |
| Addenda Published (if needed) | Week of Sept 25, 2023 |
| Proposal Due Date | October 17, 2023, 11:00 a.m. (Local Time) |
| Selection/Negotiations | October/November 2023 |
| Expected City Council Authorizations | November 2023 |

The above schedule is for information purposes only and is subject to change at the City's discretion.

Q. IRS FORM W-9

The selected bidder will be required to provide the City of Ann Arbor an IRS form W-9.

R. RESERVATION OF RIGHTS

1. The City reserves the right in its sole and absolute discretion to accept or reject any or all proposals, or alternative proposals, in whole or in part, with or without cause.
2. The City reserves the right to waive, or not waive, informalities or irregularities in terms or conditions of any proposal if determined by the City to be in its best interest.
3. The City reserves the right to request additional information from any or all bidders.
4. The City reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested within RFP.
5. The City reserves the right to determine whether the scope of the project will be entirely as described in the RFP, a portion of the scope, or a revised scope be implemented.
6. The City reserves the right to select one or more contractors or service providers to perform services.
7. The City reserves the right to retain all proposals submitted and to use any ideas in a proposal regardless of whether that proposal is selected. Submission of a proposal indicates acceptance by the firm of the conditions contained in this RFP, unless clearly and specifically noted in the proposal submitted.
8. The City reserves the right to disqualify proposals that fail to respond to any requirements outlined in the RFP, or failure to enclose copies of the required documents outlined within the RFP.

S. IDLEFREE ORDINANCE

The City of Ann Arbor adopted an idling reduction Ordinance that went into effect July 1, 2017. The full text of the ordinance (including exemptions) can be found at: www.a2gov.org/idlefree.

Under the ordinance, No Operator of a Commercial Vehicle shall cause or permit the Commercial Vehicle to Idle:

- (a) For any period of time while the Commercial Vehicle is unoccupied; or
- (b) For more than 5 minutes in any 60-minute period while the Commercial Vehicle is occupied.

In addition, generators and other internal combustion engines are covered

- (1) Excluding Motor Vehicle engines, no internal combustion engine shall be operated except when it is providing power or electrical energy to equipment or a tool that is actively in use.

T. ENVIRONMENTAL COMMITMENT

The City of Ann Arbor recognizes its responsibility to minimize negative impacts on human health and the environment while supporting a vibrant community and economy. The City further recognizes that the products and services the City buys have inherent environmental and economic impacts and that the City should make procurement decisions that embody, promote, and encourage the City's commitment to the environment.

The City encourages potential vendors to bring forward emerging and progressive products and services that are best suited to the City's environmental principles.

U. MAJOR SUBCONTRACTORS

The Bidder shall identify each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over \$50,000, whichever is less. The Bidder also shall identify the work to be subcontracted to each major subcontractor. The Bidder shall not change or replace a subcontractor without approval by the City.

N. LIQUIDATED DAMAGES

A liquidated damages clause, as given on page C-2, Article III of the Contract, provides that the Contractor shall pay the City as liquidated damages, and not as a penalty, a sum certain per day for each and every day that the Contractor may be in default of completion of the specified work, within the time(s) stated in the Contract, or written extensions.

Liquidated damages clauses, as given in the General Conditions, provide further that the City shall be entitled to impose and recover liquidated damages for breach of the obligations under Chapter 112 of the City Code.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

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SECTION II - SCOPE OF WORK

Please see the plan set and specifications for more details.

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SECTION III - MINIMUM INFORMATION REQUIRED

PROPOSAL FORMAT

The following describes the elements that should be included in each of the proposal sections and the weighted point system that will be used for evaluation of the proposals.

Bidders should organize Proposals into the following Sections:

- A. Qualifications, Experience and Accountability
- B. Workplace Safety
- C. Workforce Development
- D. Social Equity and Sustainability
- E. Schedule of Pricing/Cost
- F. Authorized Negotiator
- G. Attachments

Bidders are strongly encouraged to provide details for all of the information requested below within initial proposals. Backup documentation may be requested at the sole discretion of the City to validate all of the responses provided herein by bidders. False statements by bidders to any of the criteria provided herein will result in the proposal being considered non-responsive and will not be considered for award.

Pursuant to Sec 1:325 of the City Code which sets forth requirements for evaluating public improvement bids, Bidders should submit the following:

A. Qualifications, Experience and Accountability - 20 Points

1. Qualifications and experience of the bidder and of key persons, management, and supervisory personnel to be assigned by the bidder.
2. References from individuals or entities the bidder has worked for within the last five (5) years including information regarding records of performance and job site cooperation.
3. Evidence of any quality control program used by the bidder and the results of any such program on the bidder's previous projects.
4. A statement from the bidder as to any major subcontractors it expects to engage including the name, work, and amount.

B. Workplace Safety – 20 Points

1. Provide a copy of the bidder's safety program, and evidence of a safety-training program for employees addressing potential hazards of the proposed job site. Bidder must identify a designated qualified safety representative responsible for bidder's safety program who serves as a contact for safety related matters.
2. Provide the bidder's Experience Modification Rating ("EMR") for the last three consecutive years. Preference within this criterion will be given to an EMR of 1.0 or less based on a three-year average.
3. Evidence that all craft labor that will be employed by the bidder for the project has, or will have prior to project commencement, completed at least an authorized 10-hour OSHA Construction Safety Course.
4. For the last three years provide a copy of any documented violations and the bidder's corrective actions as a result of inspections conducted by the Michigan Occupational Safety & Health Administration (MIOSHA), U.S. Department of Labor – Occupational Safety and Health Administration (OSHA), or any other applicable safety agency.

C. Workforce Development – 20 Points

1. Documentation as to bidder's pay rates, health insurance, pension or other retirement benefits, paid leave, or other fringe benefits to its employees.
- 2.. Documentation that the bidder participates in a Registered Apprenticeship Program that is registered with the United States Department of Labor Office of Apprenticeship or by a State Apprenticeship Agency recognized by the USDOL Office of Apprenticeship. USDOL apprenticeship agreements shall be disclosed to the City in the solicitation response.
3. Bidders shall disclose the number of non-craft employees who will work on the project on a 1099 basis, and the bidders shall be awarded points based on their relative reliance on 1099 work arrangements with more points assigned to companies with fewer 1099 arrangements. Bidders will acknowledge that the City may ask them to produce payroll records at points during the project to verify compliance with this section.

D. Social Equity and Sustainability – 20 Points

1. A statement from the bidder as to what percentage of its workforce resides in the City of Ann Arbor and in Washtenaw County, Michigan. The City will consider in

evaluating which bids best serve its interests, the extent to which responsible and qualified bidders employ individuals in either the city or the county. Washtenaw County jurisdiction is prioritized for evaluation purposes for this solicitation.

2. Evidence of Equal Employment Opportunity Programs for minorities, women, veterans, returning citizens, and small businesses.
3. Evidence that the bidder is an equal opportunity employer and does not discriminate on the basis of race, sex, pregnancy, age, religion, national origin, marital status, sexual orientation, gender identity or expression, height, weight, or disability.
4. The bidder's proposed use of sustainable products, technologies, or practices for the project, which reduce the impact on human health and the environment, including raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and waste management.
5. The bidder's environmental record, including findings of violations and penalties imposed by government agencies.

E. Schedule of Pricing/Cost – 20 Points

Company: _____

Bid Items Notes –

1. Provide a Unit Price and Total Price for all bid items specified in Division 01 Section “Measurement and Payment” and herein.
2. Quantities included in the bid table represent estimated quantities for different work. The CONTRACTOR shall be compensated for the actual number of items completed using the unit prices provided.
3. The City, at its sole discretion, may elect to delete any portion of the work delineated below, with no change to the unit prices provided. Work shall be determined based upon the availability of funds.
4. Any item not provided in the following list shall be considered incidental.
5. Contract shall be awarded based on the base bid or any combination of a base bid and alternate bid in any manner the City believes to be in its best interest.

Base Bid Items –

For the entire work outlined in these documents for **RFP 23-50 – Ultraviolet (UV) Disinfection System Replacement Project**, complete as specified, using equipment and materials only of the type and manufacturers where specifically named.

| | Description | Unit | Quantity | Unit Cost | Extended Cost |
|-----|---|------|----------|----------------|----------------|
| 1.0 | General Conditions (max 10%) | LS | 1 | | |
| 1.1 | Mobilization (max 10%) | LS | 1 | | |
| 1.2 | Permit Allowance | LS | 1 | \$15,000.00 | \$10,000.00 |
| 1.3 | ¹ UVSS Balance of Work | LS | 1 | \$1,269,949.00 | \$1,269,949.00 |
| 1.4 | Installation of All Work (except UV Disinfection Building) | LS | 1 | | |
| 1.5 | Electrical, Instrumentation & Controls | LS | 1 | | |
| 1.6 | UV Disinfection Building | LS | 1 | | |
| 1.7 | Start-up, Commissioning, Training | LS | 1 | | |
| 1.8 | Special Inspections | LS | 1 | | |
| 1.9 | Maintenance of Plant Operations | LS | 1 | | |

BASE BID TOTAL: _____ (\$ _____)

1. The UVSS Balance of Work is defined in Trojan Technologies accepted shop drawing, which is included in Appendix 1 of the Technical Specification Section 46 66 56. Trojan Technologies bid form is also included in this Appendix and is summarized below:

| | |
|------------------------------|-----------------------|
| Balance of Equipment | \$915,720.00 |
| Spare Parts | \$46,620.00 |
| Services | \$44,000.00 |
| Owner Training | \$3,000.00 |
| Testing Support | \$4,500.00 |
| RFP 23-13 Bid Alternate D | \$256,109.00 |
| | |
| Balance of Work Total | \$1,269,949.00 |

Alternates

Bidder shall list alternate bid item prices below.

Alternate 1 – Extend 12-month Warranty to 36 months

As defined in Trojan Technologies proposal in response to RFP 23-13, Alternate A value was set as indicated below.

Add/Subtract (Circle One) 52,000.00

Alternate 2 – Extend 12-month Warranty Bond to 36 months

As defined in Trojan Technologies proposal in response to RFP 23-13, Alternate B value was set as indicated below.

Add/Subtract (Circle One) 5,500.00

Alternate 3 –

Add/Subtract (Circle One) _____

F. AUTHORIZED NEGOTIATOR / NEGOTIATIBLE ELEMENTS (ALTERNATES)

Include the name, phone number, and e-mail address of persons(s) in your organization authorized to negotiate the agreement with the City.

The proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the bidder wishes to quote alternate items for consideration by the City, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

If the Bidder takes exception to the time stipulated in Article III of the Contract, Time of Completion, page C-2, it is requested to stipulate its proposed time for performance of the work.

Consideration for any proposed alternative items or time may be negotiated at the discretion of the City.

G. ATTACHMENTS

General Declaration, Legal Status of Bidder, Conflict of Interest Form, Living Wage Compliance Form, Prevailing Wage Compliance Form and the Non-Discrimination Form should be completed and returned with the proposal. These elements should be included as attachments to the proposal submission.

PROPOSAL EVALUATION

1. The selection committee will evaluate each proposal by the above-described criteria and point system. The City reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested for evaluation. A proposal with all the requested information does not guarantee the proposing firm to be a candidate for an interview if interviews are selected to be held by the City. The committee may contact references to verify material submitted by the bidder.
2. The committee then will schedule interviews with the selected firms if necessary. The selected firms will be given the opportunity to discuss in more detail their qualifications, past experience, proposed work plan (if applicable) and pricing.
3. The interview should include the project team members expected to work on the project, but no more than six members total. The interview shall consist of a

presentation of up to thirty minutes (or the length provided by the committee) by the bidder, including the person who will be the project manager on this contract, followed by approximately thirty minutes of questions and answers. Audiovisual aids may be used during the oral interviews. The committee may record the oral interviews.

4. The firms interviewed will then be re-evaluated by the above criteria and adjustments to scoring will be made as appropriate. After evaluation of the proposals, further negotiation with the selected firm may be pursued leading to the award of a contract by City Council, if suitable proposals are received.

The City reserves the right to waive the interview process and evaluate the bidder based on their proposal and pricing schedules alone.

The City will determine whether the final scope of the project to be negotiated will be entirely as described in this RFP, a portion of the scope, or a revised scope.

Work to be done under this contract is generally described through the detailed specifications and must be completed fully in accordance with the contract documents.

Any proposal that does not conform fully to these instructions may be rejected.

PREPARATION OF PROPOSALS

Proposals should have no plastic bindings but will not be rejected as non-responsive for being bound. Staples or binder clips are acceptable. Proposals should be printed double sided on recycled paper.

Each person signing the proposal certifies that they are a person in the bidder's firm/organization responsible for the decisions regarding the fees being offered in the Proposal and has not and will not participate in any action contrary to the terms of this provision.

ADDENDA

If it becomes necessary to revise any part of the RFP, notice of the addendum will be posted to Michigan Inter-governmental Trade Network (MITN) www.mitn.info and/or the City of Ann Arbor web site www.A2gov.org for all parties to download.

Each bidder should acknowledge in its proposal all addenda it has received on the General Declarations form provided in the Attachments section herein. The failure of a bidder to receive or acknowledge receipt of any addenda shall not relieve the bidder of the responsibility for complying with the terms thereof. The City will not be bound by oral responses to inquiries or written responses other than official written addenda.

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SECTION IV - ATTACHMENTS

Attachment A – Sample Standard Contract

Attachment B – General Declarations

Attachment C - Legal Status of Bidder

Attachment D – Prevailing Wage Declaration of Compliance Form

Attachment E – Living Wage Declaration of Compliance Form

Attachment F – Living Wage Ordinance Poster

Attachment G – Vendor Conflict of Interest Disclosure Form

Attachment H – Non-Discrimination Ordinance Declaration of Compliance Form

Attachment I – Non-Discrimination Ordinance Poster
Sample Certified Payroll Report Template

Attachment J – Prevailing Wage Rate Determination

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ATTACHMENT A SAMPLE STANDARD CONTRACT

If a contract is awarded, the selected contractor will be required to adhere to a set of general contract provisions which will become a part of any formal agreement. These provisions are general principles which apply to all contractors of service to the City of Ann Arbor such as the following:

Administrative Use Only
Contract Date: _____

CONTRACT

THIS CONTRACT is between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and _____ ("Contractor")

(An individual/partnership/corporation, include state of incorporation) (Address)

Based upon the mutual promises below, the Contractor and the City agree as follows:

ARTICLE I - Scope of Work

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled **Ultraviolet (UV) Disinfection System Replacement, RFP 23-50** in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, all of which are incorporated as part of this Contract:

| | |
|--|-------------------------|
| Non-discrimination and Living Wage Declaration of Compliance Forms (if applicable) | General Conditions |
| Vendor Conflict of Interest Form | Standard Specifications |
| Prevailing Wage Declaration of Compliance Form (if applicable) | Detailed Specifications |
| Bid Forms | Plans |
| Contract and Exhibits | Addenda |
| Bonds | |

ARTICLE II - Definitions

Administering Service Area/Unit means **Water Resource Recovery Facility**

Project means **Ultraviolet (UV) Disinfection System Replacement, RFP 23-50**

Supervising Professional means the person acting under the authorization of the manager of the Administering Service Area/Unit. At the time this Contract is executed, the Supervising Professional is: **Anne Warrow** whose job title is **Senior Engineer**. If

there is any question concerning who the Supervising Professional is, Contractor shall confirm with the manager of the Administering Service Area/Unit.

Contractor's Representative means _____ **[Insert name]** whose job title is **[Insert job title]**.

ARTICLE III - Time of Completion

- (A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.
- (B) The entire work for this Contract (Notice to Proceed to Substantial Completion) shall be completed within three hundred sixty-five (365) consecutive calendar days. Substantial Completion to Final Completion shall be met within thirty (30) consecutive calendar days.
- (C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to \$ 500 for each calendar day of delay in the completion of all the work as described above. If any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

ARTICLE IV - The Contract Sum

- (A) The City shall pay to the Contractor for the performance of the Contract, the lump sum price as given in the Bid Form in the amount of:

_____ Dollars (\$ _____)

ARTICLE V - Assignment

This Contract may not be assigned or subcontracted any portion of any right or obligation under this contract without the written consent of the City. Notwithstanding any consent by the City to any assignment, Contractor shall at all times remain bound to all warranties, certifications, indemnifications, promises and performances, however described, as are required of it under this contract unless specifically released from the requirement, in writing, by the City.

ARTICLE VI - Choice of Law

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this Contract, the Contractor and the City agree to venue in a court of

appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

ARTICLE VII - Relationship of the Parties

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against compensation awarded for services under this Contract.

ARTICLE VIII - Notice

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing. Notice will be deemed given on the date when one of the following first occur: (1) the date of actual receipt; or (2) three days after mailing certified U.S. mail.

ARTICLE IX - Indemnification

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold the City, its officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence. The provisions of this Article shall survive the expiration or earlier termination of this contract for any reason.

ARTICLE X - Entire Agreement

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations, negotiations, agreements, or understandings whether written or oral. Neither party has relied on any prior representations in entering into this Contract. No terms or conditions of either party's invoice, purchase order or other administrative document shall modify the terms and conditions of this Contract, regardless of the other party's failure to object to such form. This Contract shall be binding on and shall inure to the benefit of the parties to this Contract and their permitted successors and permitted assigns and nothing in this Contract, express or implied, is intended to or shall confer on any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever under or by reason of this Contract.

This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

ARTICLE XI – Electronic Transactions

The City and Contractor agree that signatures on this Contract may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this Contract. This Contract may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

FOR CONTRACTOR

By _____

Its: _____

FOR THE CITY OF ANN ARBOR

By _____
Christopher Taylor, Mayor

By _____
Jacqueline Beaudry, City Clerk

Approved as to substance

By _____
Milton Dohoney, Jr., City Administrator

By _____
Brian Steglitz, Public Services Area Administrator

Approved as to form and content

Atleen Kaur, City Attorney

PERFORMANCE BOND

- (1) _____ (referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for \$ _____, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.
- (2) The Principal has entered a written Contract with the City entitled _____, for RFP No. _____ and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq.
- (3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:
- (a) complete the Contract in accordance with its terms and conditions; or
 - (b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.
- (4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.
- (5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.
- (6) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

SIGNED AND SEALED this _____ day of _____, 202_.

(Name of Surety Company)

By _____
(Signature)

Its _____
(Title of Office)

Approved as to form:

Atleen Kaur, City Attorney

(Name of Principal)

By _____
(Signature)

Its _____
(Title of Office)

Name and address of agent:

LABOR AND MATERIAL BOND

- (1) _____
of _____ (referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of \$ _____, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.
- (2) The Principal has entered a written Contract with the City entitled _____

_____, for RFP No. _____; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;
- (3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.
- (4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.
- (5) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

SIGNED AND SEALED this _____ day of _____, 202_

(Name of Surety Company)
By _____
(Signature)
Its _____
(Title of Office)

(Name of Principal)
By _____
(Signature)
Its _____
(Title of Office)

Approved as to form:

Atleen Kaur, City Attorney

Name and address of agent:

GENERAL CONDITIONS

Section 1 - Execution, Correlation and Intent of Documents

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

Section 2 - Order of Completion

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

Section 3 - Familiarity with Work

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

Section 4 - Wage Requirements

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of

subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. A sample Prevailing Wage Form is provided in the Appendix herein for reference as to what will be expected from contractors. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

If the Contractor is a "covered employer" as defined in Chapter 23 of the Ann Arbor City Code, the Contractor agrees to comply with the living wage provisions of Chapter 23 of the Ann Arbor City Code. The Contractor agrees to pay those employees providing Services to the City under this Contract a "living wage," as defined in Section 1:815 of the Ann Arbor City Code, as adjusted in accordance with Section 1:815(3); to post a notice approved by the City of the applicability of Chapter 23 in every location in which regular or contract employees providing services under this Contract are working; to maintain records of compliance; if requested by the City, to provide documentation to verify compliance; to take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee or person contracted for employment in order to pay the living wage required by Section 1:815; and otherwise to comply with the requirements of Chapter 23.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor's employees who perform work on this contract.

Section 5 - Non-Discrimination

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of MCL 37.2209. The Contractor further agrees to comply with the provisions of Section 9:158 of Chapter 112 of Title IX of the Ann Arbor City Code, and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity.

Section 6 - Materials, Appliances, Employees

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

Section 7 - Qualifications for Employment

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

Section 8 - Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

Section 9 - Permits and Regulations

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

Section 10 - Protection of the Public and of Work and Property

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or

employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

Section 11 - Inspection of Work

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

Section 12 - Superintendence

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

Section 13 - Changes in the Work

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be

executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

Section 14 - Extension of Time

Extension of time stipulated in the Contract for completion of the work will be made if and as the Supervising Professional may deem proper under any of the following circumstances:

- (1) When work under an extra work order is added to the work under this Contract;
- (2) When the work is suspended as provided in Section 20;
- (3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;
- (4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;
- (5) Delay due to an act of Government;
- (6) Delay by the Supervising Professional in the furnishing of plans and necessary information;
- (7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section I3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

- (1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;
- (2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same; the cost of all material and supplies required of either temporary or permanent character; rental of all power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;
- (3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;
- (4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;
- (5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

Section 16 - Progress Payments

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than 180 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

Section 17 - Deductions for Uncorrected Work

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

Section 18 - Correction of Work Before Final Payment

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within 10 days after written notice, the City may remove them and, if the removed material has value, may store the material

at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

Section 19 - Acceptance and Final Payment

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

- (1) The consent of the surety to payment of the final estimate;
- (2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

- (1) unsettled liens;
- (2) faulty work appearing within 12 months after final payment;
- (3) hidden defects in meeting the requirements of the plans and specifications;
- (4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

Section 20 - Suspension of Work

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the

written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

Section 21 - Delays and the City's Right to Terminate Contract

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

Section 22 - Contractor's Right to Terminate Contract

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

Section 23 - City's Right To Do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

Section 24 - Removal of Equipment and Supplies

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

Section 25 - Responsibility for Work and Warranties

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

Section 26 - Partial Completion and Acceptance

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

Section 27 - Payments Withheld Prior to Final Acceptance of Work

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

- (1) Defective work not remedied;
- (2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;
- (3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;
- (4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

Section 28 - Contractor's Insurance

- (1) The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death or property damage that may arise under this Contract; whether the act(s) or omission(s) giving rise to the claim were made by the Contractor, any subcontractor, or anyone employed by them directly or indirectly. Prior to commencement of any work under this contract, Contractor shall provide to the City documentation satisfactory to the City, through City-approved means (currently myCOI), demonstrating it has obtained the required policies and endorsements. The certificates of insurance endorsements and/or copies of

policy language shall document that the Contractor satisfies the following minimum requirements. Contractor shall add registration@mycoitracking.com to its safe sender's list so that it will receive necessary communication from myCOI. When requested, Contractor shall provide the same documentation for its subcontractor(s) (if any).

Required insurance policies include:

- (a) Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

- Bodily Injury by Accident - \$500,000 each accident
 - Bodily Injury by Disease - \$500,000 each employee
 - Bodily Injury by Disease - \$500,000 each policy limit

- (b) Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 04 13 or current equivalent. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements specifically for the following coverages: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further there shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. The following minimum limits of liability are required:

- \$1,000,000 Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.
 - \$2,000,000 Per Project General Aggregate
 - \$1,000,000 Personal and Advertising Injury
 - \$2,000,000 Products and Completed Operations Aggregate, which, notwithstanding anything to the contrary herein, shall be maintained for three years from the date the Project is completed.

- (c) Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 10 13 or current equivalent. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. Further, the limits of liability shall be \$1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

- (d) Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of \$1,000,000.

- (2) Insurance required under subsection (1)(b) and (1)(c) above shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute

with this insurance. Further, the Contractor agrees to waive any right of recovery by its insurer against the City for any insurance listed herein.

- (3) Insurance companies and policy forms are subject to approval of the City Attorney, which approval shall not be unreasonably withheld. Documentation must provide and demonstrate an unconditional and un-qualified 30-day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number(s); name of insurance company(s); name and address of the agent(s) or authorized representative(s); name(s), email address(es), and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which may be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified Contractor shall furnish the City with satisfactory certificates of insurance and endorsements prior to commencement of any work. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) and all required endorsements to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies and endorsements to the Administering Service Area/Unit at least ten days prior to the expiration date.
- (4) Any Insurance provider of Contractor shall be authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-authorized insurance companies are not acceptable unless approved in writing by the City.
- (5) City reserves the right to require additional coverage and/or coverage amounts as may be included from time to time in the Detailed Specifications for the Project.
- (6) The provisions of General Condition 28 shall survive the expiration or earlier termination of this contract for any reason.

Section 29 - Surety Bonds

Bonds will be required from the successful bidder as follows:

- (1) A Performance Bond to the City of Ann Arbor for the amount of the bid(s) accepted;
- (2) A Labor and Material Bond to the City of Ann Arbor for the amount of the bid(s) accepted.

Bonds shall be executed on forms supplied by the City in a manner and by a Surety Company authorized to transact business in Michigan and satisfactory to the City Attorney.

Section 30 - Damage Claims

The Contractor shall be held responsible for all damages to property of the City or others, caused by or resulting from the negligence of the Contractor, its employees, or agents during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. The Contractor must restore all property injured including sidewalks, curbing, sodding, pipes, conduit, sewers or other public or private property to not less than its original condition with new work.

Section 31 - Refusal to Obey Instructions

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

Section 32 - Assignment

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

Section 33 - Rights of Various Interests

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

Section 34 - Subcontracts

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

Section 35 - Supervising Professional's Status

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

Section 36 - Supervising Professional's Decisions

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

Section 37 - Storing Materials and Supplies

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

Section 38 - Lands for Work

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

Section 39 - Cleaning Up

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

Section 40 - Salvage

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.

Section 41 - Night, Saturday or Sunday Work

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

Section 42 - Sales Taxes

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

Section 43

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____, 20____, to _____, 20__, performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled _____, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

Contractor

Date

By _____
(Signature)

Its _____
(Title of Office)

Past due invoices, if any, are listed below.

STANDARD SPECIFICATIONS

All work under this contract shall be performed in accordance with the Public Services Department Standard Specifications in effect at the date of availability of the contract documents stipulated in the Bid. All work under this Contract which is not included in these Standard Specifications, or which is performed using modifications to these Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents.

Standard Specifications are available online:

<http://www.a2gov.org/departments/engineering/Pages/Engineering-and-Contractor-Resources.aspx>

DETAILED SPECIFICATIONS

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Water Resource Recovery Facility Ultraviolet (UV) Disinfection System Replacement Project

100% Specification Deliverable
ISSUE FOR BID/PERMITTING

BV Project No. 413104

September 2023

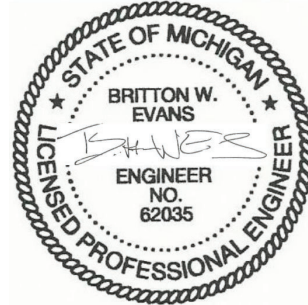


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CERTIFICATIONS

BLACK & VEATCH – GENERAL, CIVIL

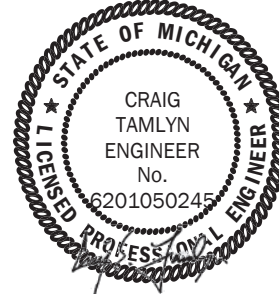
Specifications: **Division 0, 1 (except 01 67 00.3), and 2**



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JDH STRUCTURAL ENGINEERING – STRUCTURAL

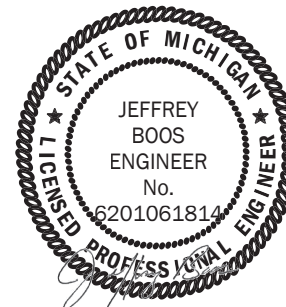
Specifications: **01 67 00.3, Division 3 and 5 (except 05 50 00, 05 50 13, 05 52 13)**



(SEAL)

BLACK & VEATCH – STRUCTURAL

Specifications: **05 50 00, 05 50 13, 05 52 13**

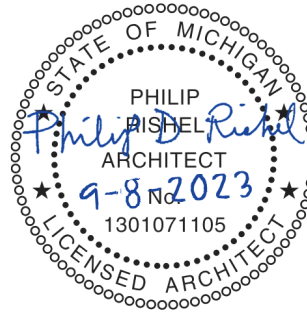


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BLACK & VEATCH – ARCHITECTURAL

Specifications: **Division 6, 7, 8, 9 and 10**



(SEAL)

BLACK & VEATCH – BUILDING MECHANICAL

Specifications: **Division 22 and 23**



(SEAL)

BLACK & VEATCH – ELECTRICAL

Specifications: **Division 26**



(SEAL)

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MOORE + BRUGGINK – PROCESS MECHANICAL

Specifications: **40 05 59, Division 46**



(SEAL)

BLACK & VEATCH – INSTRUMENTATION AND CONTROLS

Specifications: **Division 40 (except 40 05 59)**



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(SEAL)

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CITY OF ANN ARBOR
WATER RESOURCE RECOVERY FACILITY
ULTRAVIOLET (UV) DISINFECTION SYSTEM REPLACEMENT PROJECT

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Appendix 1 Trojan Technologies Fee Proposal, Bid Form and Submittal
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DIVISION 47 THROUGH 50 -NOT USED

Equipment Questionnaire

Section 00 43 31 - EQUIPMENT QUESTIONNAIRE

The Bidder shall enter in the spaces provided the names of the manufacturers of equipment which Bidder proposes to furnish, and shall submit this Equipment Questionnaire with its Bid. Owner will review and evaluate the information before award of the Contract.

Only one manufacturer's name shall be listed for each item of equipment. Upon award of a contract, the named equipment shall be furnished. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents. Substitutions shall be subject to concurrence of Owner and shall be confirmed by Change Order.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Equipment Questionnaire may be cause for rejection of the Bid.

| <u>Equipment</u> | <u>Manufacturer</u> |
|------------------|---------------------|
| 1. UV Equipment | _____ |
| 2. Slide Gates | _____ |
| 3. ----- | _____ |
| 4. ----- | _____ |
| 5. ----- | _____ |
| 6. ----- | _____ |

End of Section

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Instrumentation and Control System Supplier Questionnaire

Section 00 43 32 INSTRUMENTATION AND CONTROL SYSTEM SUPPLIER QUESTIONNAIRE

The Bidder shall submit with its Bid a copy of this Instrumentation and Control System Supplier Questionnaire completed by Bidder's intended Instrumentation and Control System Supplier. The completed Questionnaire may be a loose copy attached to the Bid. Owner will review and evaluate the information before award of the Contract.

Upon award of a contract, the named Instrumentation and Control System Supplier shall be employed to perform the work and the named equipment shall be furnished, unless changes are specifically authorized by Owner. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Instrumentation and Control System Supplier Questionnaire may be cause for rejection of the Bid.

1. Instrumentation and Control _____
System Supplier

Address _____

Telephone number _____

Instrumentation and Control System Supplier Questionnaire

2. Number of full-time design personnel on staff _____

3. Number of full-time service personnel on staff (not including personnel in Item 2 above) _____

4. Geographic location of service personnel for this Project _____

5. Number of years Supplier has successfully provided similar work _____

a. Reference – Project Owner's name _____

Address _____

Contact person's name _____

Telephone number _____

General description of project _____

Instrumentation and Control System Supplier Questionnaire

b. Reference – Project Owner's name _____

Address _____

Contact person's name _____

Telephone number _____

General description of project _____

c. Reference – Project Owner's name _____

Address _____

Contact person's name _____

Telephone number _____

General description of project _____

Instrumentation and Control System Supplier Questionnaire

6. Manufacturers of principal devices for use on this Project (one manufacturer only for each item)

a. Computer hardware _____

b. Control system application software _____

c. Historical application software _____

d. Programmable logic controllers _____

e. Magnetic flowmeters _____

f. Pressure and differential pressure transmitters _____

g. Ultrasonic level and flow transmitters _____

End of Section

Proposed Subcontractors Form

Section 00 43 36 - PROPOSED SUBCONTRACTORS FORM

In compliance with the Instructions to Bidders and other Contract Documents, the undersigned submits the following names of Subcontractors to be used in performing the Work for _____.

Bidder certifies that all Subcontractors listed are eligible to perform the Work.

| Subcontractor's Work | Subcontractor's Name |
|----------------------|----------------------|
| Concrete | _____ |
| Painting | _____ |
| Mechanical (HVAC) | _____ |
| Electrical | _____ |
| Instrumentation | _____ |
| _____ | _____ |
| _____ | _____ |

NOTE: This form must be submitted with the Bid in accordance with the Instructions to Bidders.

Proposed Subcontractors Form

Bidder's Signature

Notice to Proceed

Section 00 55 00 - NOTICE TO PROCEED

Notice to Proceed

| | | |
|-----------------------|--------|-------------------------|
| Project: | Owner: | Owner's Contract No.: |
| Contract Name: | | Engineer's Project No.: |
| Contractor: | | |
| Contractor's Address: | | |
| | | |
| | | |
| | | |

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, ✓ the date of Substantial Completion is _____, and the date of readiness for final payment is _____. ✓ the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____. ✓

Before starting any Work at the Site, Contractor must comply with the following:

Owner

Notice to Proceed

Given by:

Authorized Signature

Title

Date

Copy: Engineer

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Change Order Form

Section 00 63 63 -CHANGE ORDER FORM

CHANGE ORDER FORM

INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Contract Price or Contract Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

B. COMPLETING THE CHANGE ORDER FORM

When the subject of a change affects the performance or acceptability of the Work, the design, or other engineering and technical matters, Engineer normally initiates preparation of the form, including preparing a description of the changes involved and attachments based upon review of documents and Change Proposals submitted by Contractor, or requests from Owner, or both.

After Engineer has completed the form, all copies should be sent to Owner for approval and thence forwarding to Contractor for acceptance and signature. Owner should make distribution of executed copies after approval by both parties.

Change Order Form

If a change only applies to price or to times, insert “Zero” or “Not Applicable” to the part of the tabulation that does not apply.

Change Order Form

CHANGE ORDER

Change Order No. _____

DATE OF ISSUANCE _____

EFFECTIVE DATE _____

Owner _____

Contractor _____

Contract Name: _____

Project: _____

Owner's Contract No. _____

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE:

CHANGE IN CONTRACT TIMES:

[note changes in Milestones if applicable]

Original Contract Price

Original Contract Times:

\$ _____

Substantial Completion: _____

Ready for final payment: _____

(days or dates)

[Increase] [Decrease] from previously approved
Change Orders No. ___ to ___:

[Increase] [Decrease] from previously approved
Change Orders No. ___ to No. ___:

\$ _____

Substantial Completion: _____

Ready for final payment: _____

(days)

Contract Price prior to this Change Order:

Contract Times prior to this Change Order:

\$ _____

Substantial Completion: _____

Ready for final payment: _____

(days or dates)

Change Order Form

[Increase] [decrease] of this Change Order:

\$ _____

Contract Price incorporating this Change Order:

\$ _____

ACCEPTED:

By: _____

Owner (Authorized Signature)

Title: _____

Date: _____

[Increase] [decrease] of this Change Order:

Substantial Completion: _____

Ready for final payment: _____

(days)

Contract Times with all approved Change Orders:

Substantial Completion: _____

Ready for final payment: _____

(days or dates)

ACCEPTED:

By: _____

Contractor (Authorized Signature)

Title: _____

Date: _____

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CERTIFICATE OF SUBSTANTIAL COMPLETION

| | |
|-------------|---------------------------|
| Owner: | Owner's Contract No.: |
| Contractor: | Contractor's Project No.: |
| Engineer: | Engineer's Project No.: |
| Project: | Contract Name: |

This [preliminary] [final] Certificate of Substantial Completion applies to:

- All Work The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None
 As follows

Amendments to Contractor's responsibilities: None
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

| | | |
|-------------------------------------|---|--|
| EXECUTED BY ENGINEER: | RECEIVED: | RECEIVED: |
| By: _____ (Authorized signature) | By: _____ Owner (Authorized Signature) | By: _____ Contractor (Authorized Signature) |
| Title: _____ | Title: _____ | Title: _____ |
| Date: _____ | Date: _____ | Date: _____ |

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Acceptance Certificate Form

Section 00 65 19.23 - ACCEPTANCE CERTIFICATE FORM

ACCEPTANCE CERTIFICATE FORM

PROJECT:

OWNER:

CONTRACTOR:

OWNER'S CONSTRUCTION CONTRACT IDENTIFICATION:

EFFECTIVE DATE OF THE CONSTRUCTION CONTRACT:

ENGINEER:

NOTICE DATE:

To: _____
Owner

And To: _____
Contractor

From: _____
Engineer

The Engineer hereby gives notice to the above Owner and Contractor that Engineer has recommended final payment to Contractor, and that the Work furnished and performed by Contractor under the above Construction Contract is acceptable, expressly subject to the provisions of the related Contract Documents, the Agreement between Owner and Engineer for Professional Services dated _____, and the following terms and conditions of this Notice:

CONDITIONS OF NOTICE OF ACCEPTABILITY OF WORK

The Notice of Acceptability of Work (“Notice”) is expressly made subject to the following terms and conditions to which all those who receive said Notice and rely thereon agree:

1. This Notice is given with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer’s professional opinion.
3. This Notice is given as to the best of Engineer’s knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor’s work) under Engineer’s Agreement with Owner, and applies only to facts that are within Engineer’s knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Agreement.
5. This Notice is not a guarantee or warranty of Contractor’s performance under the Construction Contract, an acceptance of Work that is not in accordance with the related Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Construction Contract Documents, or to otherwise comply with the Construction Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner’s reservations of rights with respect to completion and final payment.

By: _____

Title: _____

Acceptance Certificate Form

Dated:

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



Standard General Conditions of the Construction Contract

These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

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CONSTRUCTION CONTRACT**

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term’s singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer’s decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision

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regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

Standard General Conditions of the Construction Contract

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

Standard General Conditions of the Construction Contract

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and

Standard General Conditions of the Construction Contract

equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

Standard General Conditions of the Construction Contract

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and

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3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items

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resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer

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any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give

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written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

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1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. abnormal weather conditions;
 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

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- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner’s interest therein as necessary for giving notice of or filing a mechanic’s or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor’s operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 - 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; or
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

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- c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

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becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

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5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in

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question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the

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Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 Contractor's Insurance

- A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

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3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 2. claims for damages insured by reasonably available personal injury liability coverage.
 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to

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industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
 - 1. include at least the specific coverages provided in this Article.
 - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 - 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

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- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

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4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such

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property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

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6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and

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incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
 - B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
 - C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional

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data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal”, which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

- D. *Effect of Engineer’s Determination:* Neither approval nor denial of an “or-equal” request shall result in any change in Contract Price. The Engineer’s denial of an “or-equal” request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

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- 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

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- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

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- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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7.09 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. 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;

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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, other work in progress, 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 Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 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 at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

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exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

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provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.

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- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any 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.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any 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, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

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Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

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or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding

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change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

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3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

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11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the

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parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

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D. *Mediation:*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval:* If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim:* If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results:* If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work:* The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

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1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

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- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
 - 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 - 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in

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Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

- E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

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1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
2. there is no corresponding adjustment with respect to any other item of Work; and
3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

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Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the

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Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials

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and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 - 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 - 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
 - 1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing

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Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

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6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.
- D. *Payment Becomes Due:*
1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.
- E. *Reductions in Payment by Owner:*
1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

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- k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch

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list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

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15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in

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Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

- C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and

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replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.

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- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

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16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

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2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

Section 01 11 13 – WORK COVERED BY CONTRACT DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK.

The City of Ann Arbor Water Resource Recovery Facility (WRRF) Ultraviolet (UV) Disinfection System Replacement Project consists of the replacement of an existing Trojan Technologies 4000 system with a Trojan Technologies UVSigna disinfection system. The scope of the project also includes replacement of the existing concrete weir structure with stainless steel weir troughs. Associated electrical and instrumentation and control equipment and will also be replaced. Upstream and downstream isolation gates will be replaced as well as actuators. The existing canopy covering the UV disinfection area will be removed and replaced with a building to fully enclose the system. The project bid price includes a line item for the purchase of the remaining balance on the UV equipment procurement. A purchase order was already given to Trojan Technologies to begin and complete the shop drawing process. Final bid price shall include all work associated with the project as outlined in the Contract Documents to complete the project.

1.2 COORDINATION.

- A. Contractor shall plan, schedule, and coordinate its operations in a manner which will facilitate the simultaneous progress of the Work under this Contract and work included under other contracts outside the scope of these Contract Documents.
- B. The provisions contained herein, particularly the Sequence of Construction, shall be coordinated, and incorporated into the Construction Schedule.
- C. The Owner shall be notified at least 7 days in advance of any planned system, equipment, or electrical shutdowns, switchovers, or lockouts. All shut-downs will be granted at the discretion of the Owner.

1.3 WORK BY OWNER

1.4 PROCUREMENT CONTRACTS

- A. Contracts for the procurement of the items of equipment and materials described in the following subparagraphs shall be assigned by Owner to Contractor as specified in the Agreement.

Work Covered by Contract Documents

- B. Shop and installation drawings pertaining to the equipment and materials are included in the Contract Documents.
- C. Equipment
 - 1. UV Disinfection System equipment
- D. Delivery
 - 1. All equipment and materials provided under the Procurement Contract will be shipped and delivered at the expense of the manufacturer and all costs shall be included in the contract price of this Contract.
 - 2. Contractor shall have the responsibility to unload the equipment and materials, and to inspect and inventory the delivered equipment and materials upon receipt at the designated location. To that end, the manufacturer will provide the services of an authorized representative at the time of delivery to assist and advise Contractor with the inventory and verification, to the mutual satisfaction of both parties. The manufacturer will perform no direct supervision of Contractor's personnel.
 - 3. The manufacturer will provide to Contractor copies of all bills of lading and other documents necessary for the inventory. Contractor shall cooperate with the manufacturer during the unloading and inventory activities, so that joint agreement can be reached. In the event of disagreement, Engineer shall be notified and decisions will be made under the terms of Article 10 of the General Conditions.
 - 4. After acceptance, Contractor shall be responsible for the handling, storage, and installation of the equipment and materials, and for administration of the assigned procurement contract, all in accordance with the Contract Documents.

1.5 RESPONSIBILITY FOR MATERIALS AND EQUIPMENT

- A. Items Furnished by Contractor.
 - 1. Contractor shall be fully responsible for all materials and equipment which it has furnished.

1.6 OFFSITE STORAGE.

- A. Offsite storage arrangements shall be approved by Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such offsite storage arrangements shall be presented in writing and shall afford

Work Covered by Contract Documents

adequate and satisfactory security and protection. Offsite storage facilities shall be accessible to Owner and Engineer.

1.7 SUBSTITUTES AND "OR-EQUAL" ITEMS

- A. Provisions for evaluation of proposed "or-equal" items of materials or equipment are covered in Paragraph 7.04 of the General Conditions. Provisions for evaluation of proposed substitute items of materials or equipment are covered in Paragraph 7.05 of the General Conditions. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

1.8 PREPARATION FOR SHIPMENT.

- A. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.
- B. Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.9 SALVAGE OF MATERIALS AND EQUIPMENT.

- A. Existing materials and equipment removed shall become Contractor's property, except for items identified in the Drawings which shall remain Owner's property].
- B. Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified or indicated to be salvaged or to remain the property of Owner. Contractor shall store and protect salvaged items .
- C. Salvaged items to remain Owner's property shall be delivered by Contractor in good condition to Owner.
- D. Any items specified or indicated to be salvaged which are damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.

1.10 LAND FOR CONSTRUCTION PURPOSES.

- A. Contractor will be permitted to use available land belonging to Owner, on or near the Site, for construction purposes and for storage of materials and equipment.

Work Covered by Contract Documents

- B. The locations and extent of the areas so used shall be as indicated on the Drawings.
- C. Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by Owner, requiring access to the storage area. Materials or equipment shall not be placed on the property of Owner until Owner has agreed to the location to be used for storage.

1.11 OPERATION OF EXISTING FACILITIES

- A. The Water Resource Recovery Facility (WRRF) treats sewage 24/7 and must remain in-service throughout construction. Wet weather and/or snow melt can cause significant increases to wastewater flow, necessitating additional equipment to be in service and staff to be unavailable to assist the Contractor, etc. As a result, some process construction areas may be vacated, and/or start-up and/or training activities may be curtailed or postponed in the event or anticipation of a rain event. This is deemed normal for WRRF construction, and no additional compensation will be made for these occurrences.
- B. The existing facilities must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. It is also imperative that access to all areas and equipment are continually provided unless otherwise stipulated herein, for the Owner to provide routine and emergency operations and maintenance. Provided permission is obtained from Owner in advance, portions of the existing facilities may be taken out of service for short periods corresponding with periods of minimum service demands.
- C. Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.
- D. Refer to Contract Drawings for detailed suggested Construction Sequencing Plan and coordination notes.
- E. Failure to complete a WRRF plant shutdown in the time allotted in the suggested Construction Sequencing Plan, or otherwise approved by WRRF staff, will result in assessment liquidated damages in the amount of \$500/hour. Contractor is encouraged to minimize quantity and duration of shutdowns to extent possible.

1.12 ALLOWANCES

- A. The Contract Price includes an allowance for the UV Disinfection Equipment.

Work Covered by Contract Documents

1.13 CONNECTIONS TO EXISTING FACILITIES

- A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures. In each case, Contractor shall receive permission from Owner. Contractor shall protect facilities against deleterious substances and damage.
- B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.14 UNFAVORABLE CONSTRUCTION CONDITIONS

- A. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

1.15 HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE

- A. No Hazardous Environmental Conditions at the Site in areas that will be affected by the Work are known to the Owner.

1.16 CLEANING UP

- A. Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.
- B. Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
- C. Volatile wastes shall be properly stored in covered metal containers and removed daily.

Work Covered by Contract Documents

- D. Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.
- E. Adequate cleanup will be a condition for recommendation of progress payment applications.

1.17 APPLICABLE CODES

- A. Standard codes which apply to the Work are designated in the Specifications.

1.18 REFERENCE STANDARDS

- A. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of opening of Bids (or on the effective date of the Contract or Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- B. However, no provision of any referenced standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Owner, Engineer, or any of Engineer's Consultants, agents, or employees, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

1.19 PRECONSTRUCTION CONFERENCE

- A. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:
 - 1. Contractor and its superintendent.
 - 2. Principal Subcontractors.
 - 3. Representatives of principal Suppliers and manufacturers as appropriate.
 - 4. Engineer and its Resident Project Representative.
 - 5. Representatives of Owner.

Work Covered by Contract Documents

6. Government representatives as appropriate.
 7. Others as requested by Contractor, Owner, or Engineer.
- B. Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:
1. Progress Schedule.
 2. Schedule of Values for progress payment purposes.
 3. Schedule of Shop Drawings and other submittals.
- C. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:
1. Contractor's preliminary schedules.
 2. Transmittal, review, and distribution of Contractor's submittals.
 3. Processing Applications for Payment.
 4. Maintaining record documents.
 5. Critical Work sequencing.
 6. Field decisions and Change Orders.
 7. Use of premises, office and storage areas, security, housekeeping, and Owner's needs.
 8. Major equipment deliveries and priorities.
 9. Contractor's assignments for safety and first aid.
- D. Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1.20 PROGRESS MEETINGS

- A. Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by Engineer or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

Work Covered by Contract Documents

- B. Contractor shall preside at the meetings. Meeting minutes shall be prepared and distributed by Contractor. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

1.21 SITE ADMINISTRATION

- A. Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others.
- B. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

1.22 PERMIT COMPLIANCE

- A. During construction (mobilization through Final Completion), Contractor is responsible for adhering to all City of Ann Arbor's permit limit requirements including, but not limited to, their National Pollutant Discharge Elimination System (NPDES) permit, Michigan Department of Environment, Great Lakes and Energy (EGLE) Part 41 permit, etc. Any violation of these stated limits will be the responsibility of the Contractor. Contractor shall coordinate with the WRRF for all plant shutdowns, disinfection operations, sampling, start-up and commissioning activities, etc.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Measurement and Payment

Section 01 22 00 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers descriptions of the measurement and basis of payment for items of Work under this Contract.
- B. Basis of Contract Payments
 - 1. Final Contract Price shall be determined by actual quantities installed at unit prices stated in Contractor's Bid.
 - 2. Engineer shall determine actual as-built quantities.
 - 3. All work identified on the Drawings, but not included as a Bid item shall be considered incidental to construction and not paid for directly, except Work that would be considered additional Work due to unforeseen conditions.
 - 4. Unit price payments for individual items shall include everything necessary for such item to function as intended in the system.
 - 5. Owner reserves the right to increase, decrease or eliminate any quantities for items listed in Contractor's Bid or which become a part of the Contract Documents.
 - 6. Plugs, taps, valves, and other appurtenances not shown on the construction drawings which are installed for Contractor's use to complete the work shall not be measured for payment.
- C. Items included as incidental to Unit Prices for systems and appurtenances. Unless there is a specific pay item identified, the unit price payment shall include, but not be limited to:
 - 1. Drainage of excavations and structures including by-pass pumping if necessary.
 - 2. Temporary sheeting, bracing and shoring of excavations.
 - 3. Support, relocation, replacement, connection or reconnection of existing pipelines and utilities.
 - 4. Cleanup and surface restoration.
 - 5. Bulkhead of pipes and channels as necessary.
 - 6. Temporary enclosures and sources of heat and humidity control to allow construction activity to proceed during cold weather and adverse conditions.
 - 7. Submittals - shop drawings, operations and maintenance manual, etc.
 - 8. Product testing and inspections.
 - 9. Manufacturer field services
 - 10. Startup and testing
 - 11. Warranty requirements

Measurement and Payment

1.2 BID ITEMS

- A. General Conditions (max 10%)
 - 1. Includes:
 - a. General Overhead
 - b. Project Management
 - c. Provide insurance, bonds, and other costs associated with the project in general and not included in other pay items.
 - d. All required submittals.
 - 2. Unit of Measure:
 - a. Lump Sum.
 - b. Contractor request payment based on percentage of work complete.
- B. Mobilization (max 10%)
 - 1. Includes:
 - a. Preparatory work and expenses incurred prior to beginning work onsite.
 - b. Transport materials, personnel, and equipment to the job site.
 - c. Establish temporary onsite construction facilities.
 - d. Costs associated with the project in general and not included in other pay items.
 - 2. Unit of Measure:
 - a. Lump Sum.
 - b. 50% payment will be made after 5% of the original contract amount is earned.
 - c. Final 50% payment will be made after 25% of the contract amount is earned.
- C. Permit Allowance
 - 1. Includes:
 - a. Includes cash allowance for obtaining permits not included in Contract Documents.
 - b. Unit of Measure:
 - 1) Cost for permit fees and associated inspections.
 - 2) Documents by invoice/receipt.
- D. UVSS Balance of Work
 - 1. Includes the following in accordance with Division 46 Section "Open Channel UV Disinfection System" and Trojan Technologies proposal included in Appendix 1.
 - 2. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.
- E. Installation of All Work
 - 1. Includes all materials, equipment, and labor to remove the existing UV equipment, associated electrical, controls and appurtenances.
 - 2. Includes all materials, equipment, and labor for installation of the new UV Equipment, slide gates, appurtenances, and all related work.
 - 3. Unit of Measurement:

Measurement and Payment

- a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.
- F. Electrical, Instrumentation and Controls
1. Includes all materials, equipment, and labor to perform the electrical work associated with removal of the existing UV disinfection system and installation of the new system.
 2. Includes all materials, equipment, and labor to perform the instrumentation and controls work associated with the installation and programming of the new UV disinfection system, including control wiring and conduits and all related Work.
 3. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.
- G. UV Disinfection Building
1. Includes removal and disposal of the existing UV canopy as indicated in the Contract Documents.
 2. Includes all materials, equipment, and labor to erect the UV building as indicated in the Contract Documents.
 3. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.
- H. Start-up, Commissioning, Training
1. Includes all scheduling and coordination of necessary parties, sampling, disposal of disinfected water as approved, coordination with the City of Ann Arbor for commissioning (Section 01 91 00) and all labor, materials and equipment necessary to complete work.
 2. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.
- I. Special Inspections
1. Includes all scheduling and coordination of necessary parties, including the City of Ann Arbor to complete Special Inspections as indicated in the Contract Documents.
 2. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.

Measurement and Payment

J. Maintenance of Plant Operations

1. Includes all materials, equipment, and labor to install bulkheads, coffer dams, etc., needed to isolate pipelines and channels in order to ensure maintenance of plant operations (MOPO) throughout construction.
2. Includes coordination with Engineer and City of Ann Arbor prior to implementing MOPO devices.
3. Unit of Measurement:
 - a. Lump Sum
 - b. Contractor request payment based on percentage of work complete.

PART 1 - PRODUCTS (NOT USED)

PART 2 - EXECUTION (NOT USED)

End of Section

Progress Payment Procedures

Section 01 29 76 – PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers methods of measurement and payment for items of Work under this Contract.

1.2 GENERAL.

- A. The Contract Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.
- B. Contractor to submit pay applications as outlined in Section 16 of the General Conditions.

PART 1 - PRODUCTS (NOT USED)

PART 2 - EXECUTION (NOT USED)

End of Section

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Construction Progress Documentation

Section 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SCHEDULE OF VALUES.

- A. After review of the preliminary schedule at the preconstruction conference, and before submission of the first Application for Payment, Contractor shall prepare and submit to Engineer a Schedule of Values covering each lump sum item. The Schedule of Values, showing the value of each kind of work, shall be acceptable to Engineer before any Application for Payment is prepared.
- B. The sum of the items listed in the Schedule of Values shall equal the Contract Price. Such items as Bond premium, temporary construction facilities, and plant may be listed separately in the Schedule of Values, provided the amounts can be substantiated. Overhead and profit shall not be listed as separate items.
- C. The Schedule of Values shall have sufficient detail such that partial completion of separable items of work can easily be calculated. The Schedule of Values shall have separate lines for manufacturer's field services, O&M manuals, and performance testing for each item of equipment requiring such services.
- D. An unbalanced Schedule of Values providing for overpayment of Contractor on items of Work which would be performed first will not be accepted. The Schedule of Values shall be revised and resubmitted until acceptable to Engineer. Final acceptance by Engineer shall indicate only consent to the Schedule of Values as a basis for preparation of applications for progress payments, and shall not constitute an agreement as to the value of each indicated item.

1.2 SCHEDULE OF PAYMENTS

- A. Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

1.3 LAYOUT DATA.

- A. Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Resident Project Representative for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section

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Section 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 GENERAL OVERVIEW.

- A. A Progress Schedule shall be used to control the Work and to provide a definitive basis for determining project progress. The Progress Schedule shall be prepared, maintained and updated by Contractor and historical dates agreed monthly with Engineer. Contractor shall submit a preliminary Progress Schedule and a Progress Schedule for acceptance by Engineer. These schedules shall be Contractor's working schedules and shall be used to plan, organize and execute the Work, record and report actual performance and progress, and show how Contractor plans to complete all remaining Work as of the end of each progress report period.
- B. The Progress Schedule shall comprise all the detailed construction-related activities using the critical path method (CPM). The Progress Schedule shall provide sufficient detail and clarity to reflect the intricacies and interdependencies of activities so Contractor can plan, schedule, monitor, control and report on the progress of his work. In addition, it shall provide Engineer and Owner a tool to monitor and follow the progress for all phases of the Work.
- C. The Contractor's schedule must comply with the City's observed holidays as specified. The City of Ann Arbor's noise ordinance is specified in Chapter 119 – Noise Control in the Code of Ordinances. All activities on site must comply with the required hours and sound levels as specified in the ordinance.

1.2 PRELIMINARY PROGRESS SCHEDULE.

- A. Within ten calendar days after the Effective Date of the Contract, Contractor shall submit a preliminary Progress Schedule for review by Engineer. The preliminary Progress Schedule shall show detailed construction-related activities for the first 45 days of the project. The remainder of the Contract activities shall be shown as summary bars within the milestones of the Work. If Engineer has comments on the preliminary Progress Schedule, Contractor shall make the necessary changes and resubmit it within ten calendar days. No progress payments will be made during the period specified above for the preliminary Progress Schedule until the preliminary Progress Schedule has been accepted by Engineer.
- B. The preliminary Progress Schedule shall:
 - 1. Illustrate a feasible schedule for completion of the Work within the Contract Times specified.

Construction Progress Schedule

2. Include the activity code structure as described in Paragraph 19 of this specification.

1.3 PROGRESS SCHEDULE.

- A. The Progress Schedule comprises all the construction-related activities for the Work and shall show the order in which Contractor proposes to carry out the work. Contractor shall include milestones, coordination necessitated by limited access and available work areas, and the availability and use of manpower, material and equipment. Contractor shall use the Progress Schedule to plan, schedule and coordinate the Work including activities of subcontractors, equipment vendors, and suppliers.
- B. The Progress Schedule shall be to the level of detail acceptable to Engineer, and shall include the following:
 1. Organization and structural breakdown of the Project;
 2. Milestones and completion dates;
 3. Type of work to be performed and the labor trades involved;
 4. Purchase, manufacture and delivery activities for major materials and equipment;
 5. Preparation, submittal, and acceptance of shop drawings and material samples;
 6. Deliveries of equipment and/or materials;
 7. Acceptances required by regulatory agencies and/or other third parties;
 8. Assignment of responsibility for each activity;
 9. Access requirements to work areas;
 10. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors;
 11. Tests, submittal of test reports and acceptance of test results;
 12. Planning for phased or total acceptance by Owner; including start up and commissioning;
 13. Training – two sessions for each training to accommodate different work shifts;
 14. Identification of any manpower, material and equipment restrictions;
 15. Sequence of construction to maintain plant operations;
 16. Planned outages.

Construction Progress Schedule

- C. The activities included in the Progress Schedule shall be defined in work days. Durations shall be based on the labor (crafts), equipment, and materials required to perform each activity on a normal workday basis. Activity durations shall be 20 working days or less except in the case of non-construction activities such as procurement of materials, delivery of equipment, and concrete curing. All durations shall be the result of definitive manpower and resource planning by Contractor to perform the Work, in consideration of contractually defined on-site work conditions and Contractor's planned means and methods.
- D. When the Progress Schedule is accepted by Engineer, Engineer will save a copy of the Progress Schedule as the baseline schedule, and will use it for analysis of Contractor's progress.
- E. Contractor shall update the Progress Schedule monthly.

1.4 ELECTRONIC PROGRESS SCHEDULE FORMAT AND REPORTING.

- A. The Progress Schedule shall be created using Primavera P6, Microsoft Project, or approved scheduling software. Contractor shall use Engineer's file-naming format throughout the project.
 - 1. Electronic schedule files shall be saved with .XML or .XER file extensions.
 - 2. The data date for schedule calculation in the preliminary Progress Schedule and Progress Schedule shall be set as the date of the Notice to Proceed unless otherwise specified by Engineer.

1.5 RESOURCE-LOADING.

- A. Contractor shall assign resources to each applicable Progress Schedule activity. Resource-loading shall determine the activity duration based on the assigned resource. The report shall show the number of man-days of effort for each month over the life of the Contract. The manpower requirements forecast shall be updated monthly and shall include the actual manpower used by trade as of the current report period and the manpower required to complete the Work.

1.6 SUBMITTALS.

- A. Progress Schedule Submittals
 - 1. The Progress Schedule and associated reports shall be submitted to Engineer for acceptance within the period of the preliminary Progress Schedule specified herein. If the Progress Schedule is not submitted, no progress payments will be made after the due date until the Progress Schedule has been submitted.

Construction Progress Schedule

2. Printouts and electronic layouts required as part of the Progress Schedule submittal and monthly updates are as follows:
 - a. Summary Schedule: one page milestone and summary schedule in 11x17 sheet size;
 - b. Detailed Project Schedule: organized by Work Breakdown Structure (WBS) or area of work;
 - c. Critical Path Schedule;
 - d. 30-Day Look Ahead Schedule;
 - e. Activities in Progress: organized by WBS or area of work; sorted by total Float, early-start, early-finish.
3. Contractor shall submit additional layouts if directed by Engineer.

1.7 MONTHLY SCHEDULE UPDATES.

- A. Monthly Progress Schedule updates shall be submitted for the duration of the Contract on a date agreed to by Owner, Engineer, and Contractor. If monthly Progress Schedule updates are not submitted by the due date, progress payments will be withheld until the required information is submitted.

1.8 REVIEW PROCESS.

- A. Engineer will review Contractor's preliminary Progress Schedule and full Progress Schedule submittals within 15 calendar days after receipt of all required information.
- B. At the request of Owner or Engineer, Contractor shall participate in any meetings necessary to reach a mutual agreement and acceptance of the preliminary Progress Schedule, or Progress Schedules.
- C. If any of the required submittals are returned to Contractor for corrections or revisions, they shall be resubmitted within ten calendar days after the return mailing date. Resubmittals shall include all information and media included in the first submittal. Review and response by Engineer will be given within 10 calendar days after receipt of each resubmittal.
- D. Schedules shall show contract completion of the Work on the Contract completion date and with zero or positive total Float even if Contractor plans to finish early. In no event shall acceptance of the Progress Schedule be a basis for a claim for delay against Owner or Engineer by Contractor for an early finish. A Progress Schedule containing activities with negative Float or that extend beyond the date that the Work is completed and ready for final payment will not be acceptable.
- E. Acceptance of the Progress Schedule by Engineer does not relieve Contractor of responsibility for accomplishing the Work by the Contract completion date. Omissions and errors in the accepted Progress Schedule shall not relieve Contractor of obligations

Construction Progress Schedule

under the Contract. Acceptance by Engineer in no way makes Engineer or Owner an insurer of the Progress Schedule's success or liable for time or cost overruns. Engineer and Owner hereby disclaim any obligation or liability by reason of acceptance of the Progress Schedule by Engineer.

1.9 RESPONSIBILITY FOR SCHEDULE COMPLIANCE.

- A. Whenever it becomes apparent from the current Progress Schedule that the critical path is delayed and the contract completion date will not be met, Contractor shall mitigate the delay by taking some or all of the following actions at no additional cost to Owner.
 - 1. Increase construction manpower in such quantities and crafts as will bring the project back on schedule within the completion dates and milestones.
 - 2. Increase the number of working hours per shift, shifts per day, working days per week, and the amount of construction equipment, or any combination of the foregoing, to substantially eliminate the backlog of work.
 - 3. Re-schedule activities to achieve maximum practical concurrence of activities and to comply with the schedule date(s).
- B. Within ten calendar days of Engineer's request, Contractor shall submit a recovery schedule and written statement of the steps intended to remove or arrest the delay to the critical path in the schedule. If Contractor fails to submit the required information or should fail to take measures acceptable to Engineer, Engineer with Owner concurrence may direct Contractor to increase man-power, equipment and scheduled work hours to remove or arrest the delay to the critical path and Contractor shall promptly provide such level of effort at no additional cost to Owner.
- C. In the event Contractor fails to follow the updated or revised recovery schedule, Owner may elect to withhold progress payments until Contractor complies with the revised schedule.
- D. Should Contractor's efforts not remove or arrest the delay to the critical path of the accepted schedule, then Owner shall be entitled to supplement Contractor's work-force and equipment to remove and arrest any delay, and shall be entitled to deduct all costs and expenses associated therewith from payments due to Contractor. If insufficient Contract funds remain, Owner may recover such funds from Contractor and its Surety.

1.10 CHANGES IN THE WORK, DELAYS, AND EXTENSIONS OF TIME.

- A. When changes in the Work or delays are experienced by Contractor and Contractor requests an extension of time, Contractor shall submit a written time impact analysis to Engineer illustrating the influence of each change or delay to the current Contract Times. Each time impact analysis shall demonstrate how Contractor was delayed.

Construction Progress Schedule

- B. Each time impact analysis shall demonstrate the estimated time impact based on the events of the change or the delay; the date the change was given to Contractor or the delay incurred, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the analysis shall be those included in the latest update of the Progress Schedule or as adjusted for the events of delay.
- C. Engineer will review Contractor's time impact analysis. Contractor shall furnish such justification and supporting evidence as Engineer deems necessary to determine whether Contractor is entitled to an extension of time. Engineer's review of each time impact analysis will be made within five working days of receipt of the time impact analysis and additional information as required by Engineer, unless subsequent meetings and negotiations are necessary.
- D. The Contract Times will be adjusted only for causes specified in paragraph 15. Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining Float along the critical path at the time of actual delay. Delays in activities which are not on the critical path and do not affect Contract Times, will not be considered for an extension of time.

1.11 CAUSES FOR EXTENSIONS OF TIME.

- A. Additional positive total Float in the Progress Schedule generated by efficiencies of Owner or Contractor is a shared commodity to be reasonably used by either party, and belongs exclusively to the Project. Contractor is not entitled to any additional compensation for completion of the project prior to expiration of the Contract Times.
- B. Owner-Initiated Changes. Owner initiated changes to the Work that absorb Float time will not be considered for an extension of time. Owner-initiated changes that affect the critical path of the Progress Schedule shall be grounds for extending or shortening completion dates. Use of Float time for Contractor initiated changes will require Owner's concurrence. Contractor's changes, however, shall give way to Owner-initiated changes competing for the same Float time.
- C. Outside Contractor's Control. Events outside of Contractor's control that affect the critical path of the Progress Schedule will be considered for an extension or reduction of the Contract Times.
- D. Weather Delays. Engineer will obtain weather data during construction from a reputable source, and will maintain weather records.
 - 1. Engineer will determine Contractor's entitlement to an extension of the Contract Times as a result of weather delays, based on the flow chart in Figure 1-01 32 16 and the data included in Tables 1, 2 and 3 . Extensions of time will be granted at the discretion of Engineer for circumstances not covered by the flow chart.

Construction Progress Schedule

2. Any weather-related extension of Contract Times shall be non-compensable. Efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated weather days is less than expected, shall contribute to the project Float and shall not affect the Contract Times.
3. Application for a weather related extension of time shall be submitted to Engineer, using form 1-01 32 16, and shall state the extension requested and be supported by the relevant weather data.
4. Contractor shall include the number of days, for each calendar period, from Tables 2 and 3 in the Project Schedule. Days shall be labeled as Extreme Weather Float. Extreme Weather Conditions that affect the Critical Path of the Progress Schedule, in excess of the Extreme Weather Float, will be considered for an extension or reduction of the Contract Times. Notification for all extreme weather related events must be submitted no later than 72 hours after the weather impact date.

| | | | | | | | | | | | |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <p>Table 1 Average Monthly Precipitation (inches) 10 year average 2012 – 2022 NOAA National Centers for Environmental Information, Annual Climatological Summaries</p> | | | | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 2.7 | 2.6 | 3 | 3.6 | 3.9 | 4.4 | 3.1 | 3.9 | 3.2 | 3.5 | 2.3 | 2.6 |

| | | | | | | | | | | | |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <p>Table 2 Average Number of Calendar Days with Precipitation of 0.10 Inches or More in a Single 24-hour Period 10 year average 2012 – 2022 NOAA National Centers for Environmental Information, Annual Climatological Summaries</p> | | | | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 7 | 7 | 6 | 9 | 9 | 7 | 7 | 6 | 6 | 8 | 6 | 7 |

| Table 3 Average Number of Calendar Days with Temperature less than 0 °F or greater than 90 °F 10 year average 2012 – 2022 NOAA National Centers for Environmental Information, Annual Climatological Summaries | | | | | | | | | | | |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 3 | 2 | 0 | 0 | 0 | 2 | 6 | 2 | 2 | 0 | 0 | 1 |

5. Table 3 includes historical weather data for the average number of days recorded where temperature could be considered extreme. Not every day listed in Table 3 will result in an Extreme Weather Condition. A subsequent determination shall be done based on the Heat Index Apparent Temperature or Wind Chill Index.
6. Justification for an extension or reduction of the Contract Times as a result of extreme temperature shall be determined based on the Heat Index Apparent Temperature or Wind Chill Index using formulas below. The Heat Index and Wind Chill Temperature limits for determining the extreme temperature event shall be those listed in Figure 1-01 32 16.

a. Heat Index:

$$\begin{aligned}
 HI = & -42.379 + 2.04901523 \times T + 10.14333127 \times RH - 0.22475541 \times T \times RH - \\
 & 0.00683783 \times T \times T - 0.05481717 \times RH \times RH + 0.00122874 \times T \times T \times RH + \\
 & 0.00085282 \times T \times RH \times RH - 0.00000199 \times T \times T \times RH \times RH
 \end{aligned}$$

Where:

HI = Heat Index Expressed as an Apparent Temperature in Degrees Fahrenheit (°F)

T = Average Day Temperature in Degrees Fahrenheit (°F)

RH = Average Day Relative Humidity in Percent (%)

If the RH is less than 13% and the temperature is between 80 and 112 degrees Fahrenheit (°F), then the following adjustment is subtracted from HI:

Construction Progress Schedule

$$\text{ADJUSTMENT} = [(13 - \text{RH})/4] \times \text{SQRT} \{ [17 - \text{ABS}(T - 95)]/17 \}$$

Where:

HI = Heat Index Expressed as an Apparent Temperature in Degrees Fahrenheit (°F)

T = Average Day Temperature in Degrees Fahrenheit (°F)

RH = Average Day Relative Humidity in Percent (%)

SQRT = Square Root Function

If the RH is greater than 85% and the temperature is between 80 and 87 degrees Fahrenheit (°F), then the following adjustment is added to HI:

$$\text{ADJUSTMENT} = [(\text{RH} - 85)/10] \times [(87 - T)/5]$$

Where:

HI = Heat Index Expressed as an Apparent Temperature in Degrees Fahrenheit (°F)

T = Average Day Temperature in Degrees Fahrenheit (°F)

RH = Average Day Relative Humidity in Percent (%)

b. Wind Chill Index:

$$\text{WC} = 35.74 + 0.6215 \times T - 35.75 \times V^{0.16} + 0.4275 \times T \times V^{0.16}$$

Where:

WC = Wind Chill Index Expressed as a Temperature in Degrees Fahrenheit (°F)

T = Average Day Temperature in Degrees Fahrenheit (°F)

V = Wind Speed in Miles per Hour (mph)

1.12 OBSERVED HOLIDAYS

A. The holidays observed by Owner are as follows:

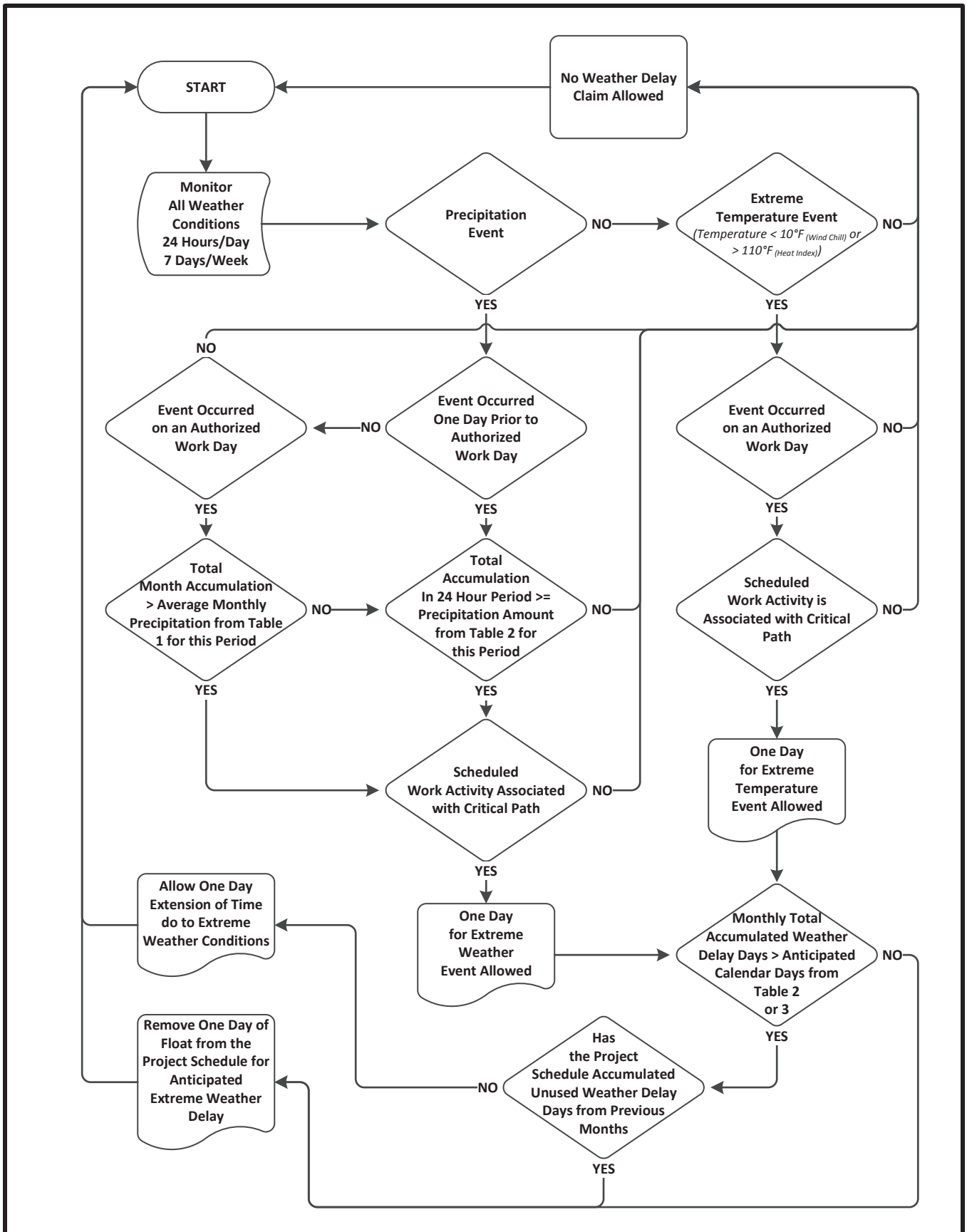
Construction Progress Schedule

1. New Year's Day
 2. Birthday of Martin Luther King, Jr.
 3. Presidents' Day
 4. Memorial Day
 5. Juneteenth
 6. July 4th
 7. Labor Day
 8. Indigenous Peoples' Day
 9. Veterans' Day
 10. Thanksgiving Day
 11. Christmas Eve
 12. Christmas Day
- B. The Contractor is permitted to work on Saturdays and holidays with prior approval from the City.
- C. Sunday work is not allowed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section



**EXTREME WEATHER EVENT DELAY CLAIM
DECISION MAKING FLOW CHART**



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Photographic Documentation

Section 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 CONSTRUCTION PHOTOGRAPHS BY CONTRACTOR.

- A. Contractor shall be responsible for the production of construction photographs as provided herein. Engineer shall designate the subject of each photograph.
- B. For plant projects, 200 photographs of the entire site, or pertinent features thereof, shall be taken before the commencement of Work and promptly submitted to Engineer. The same views shall be rephotographed upon completion of all construction activities and submitted with Contractor's application for final payment. 50 additional photographs shall be made each month throughout the progress of the Work at such times as requested by Engineer, and submitted with Contractor's application for progress payment.
- C. All photographs shall be color digital, produced by a competent professional photographer. Contractor shall submit the photographs electronically and two copies of 4 by 5 inch prints. Digital images shall be compiled on USB flash drive and provided with a descriptive index of the images.
- D. Engineer will transmit the digital files and the USB flash drive to Owner.

1.2 CONSTRUCTION VIDEO BY CONTRACTOR

- A. Preconstruction Audio-Video (A-V) is required to record and document the existing conditions prior to the start of construction.
- B. Contractor shall engage the services of a professional videographer actively engaged in audio-video recordings of projects similar to the work included under this Contract.
- C. Drone videos may be accepted in lieu of photographs depending on type of work.

1.3 QUALITY ASSURANCE

- A. The firm shall have at least 10 year performing videography of work similar in nature and scope. The videographer shall have at least 5 years of professional experience in performing work of similar scope and magnitude.
- B. Provide references for the firm and videographer and his/her resume.
- C. The firm performing this work shall have the equipment and experience necessary to produce Full HD 1920 x 1080 audio-video recordings.

Photographic Documentation

- D. The Engineer may require the video taping of a “sample” to verify the ability of the videographer to perform the work.
- E. All digital recordings and written records shall become the property of the Owner. The firm performing this work shall also provide one complete copy of all DVD discs and written records to the Engineer.

1.4 SUBMITTALS

- A. Submit digital recordings per 01 33 00.
- B. All digital recordings and written records shall become the property of the Owner. The firm performing this work shall also provide one complete copy of all DVD discs and written records to the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Submittal Procedures

Section 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND ENGINEERING DATA.

A. General.

1. The Project has been designed by Engineer and Engineer will perform design-intent reviews of submittals. Owner, Engineer, and Contractor may develop a protocol for the transmittal of shop drawings, samples, and other submittals.
2. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.
3. Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor's initial submittal shall be complete including all components.
4. All submittals, regardless of origin, shall be approved by Contractor and clearly identified with the name and number of this Contract, Contractor's name, and references to applicable specification paragraphs and Contract Drawings. Each copy of all submittals, regardless of origin, shall be stamped or affixed with an approval statement of Contractor. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.
5. All deviations from the requirements of the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal using Figure 2-01300. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

Submittal Procedures

6. Contractor shall submit shop drawings electronically only. All submittals shall be made with the selected method, and Contractor shall inform Engineer by letter within seven days after award of the Contract the method that has been selected. Submittals made by any method other than that selected by Contractor, will be returned without review.
7. Drawings and necessary data shall be submitted electronically to Engineer as specified below. Submittal documents shall be in color to facilitate use of red line markups.
 - a. All electronic files shall be in Portable Document Format (PDF) as generated by Adobe Acrobat Professional Version 7.0 or higher.
 - b. The PDF file(s) shall be fully indexed using the Table of Contents, searchable with thumbnails generated. PDF images must be at a readable resolution.
 - c. For most documents, they should be scanned or generated at 300 dots per inch (dpi). Use of higher resolution is acceptable with Owner and Engineer approval.
 - d. Optical Character Recognition (OCR) capture must be performed on these images so that text can be searched, selected and copied from the generated PDF file.
 - e. The PDF documents shall have a bookmark created in the navigation frame for each major entry (“Section” or “Chapter”) in the Table of Contents.
 - f. Thumbnails shall be generated for each page or graphic in the PDF file.
 - g. The opening view for each PDF document shall be as follows:
 - 1) Initial View: Bookmarks and Page
 - 2) Magnification: Fit In Window
 - 3) The file shall open to Contractor’s transmittal letter, with bookmarks to the left. The first bookmark shall be linked to the Table of Contents.
 - h. PDF document properties shall include the submittal number for the document title and Contractor’s name for the author.
 - i. Electronic submittal file sizes shall be limited to 25 MB. When multiple files are required for a submittal the least number of files possible shall be created.
8. Contractor shall post/submit submittals electronically to the Engineer. Engineer's submittal review comments will be returned electronically. Instruction on procedures for posting and retrieving submittals will be provided after award of the Contract.
 - a. Contractor can utilize their own document management system such as Procure, Ecomm, etc. The proposed document management system must be approved by the Engineer and Owner prior to proceeding with usage.

Submittal Procedures

- b. Contractor must provide any necessary training or educational materials on how document management system is to be used free or charge to all users.
 - c. Contractor shall provide login/access information and any licensing information to the Owner and Engineer free of charge.
9. Facsimiles (fax) will not be acceptable. Submittals will not be accepted from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

B. Engineer's Review of Submittals.

1. Engineer's review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. Engineer's review shall not relieve Contractor of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor's sole responsibility for compliance with the Contract Documents.
2. Engineer's submittal review period shall be 21 consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal in Engineer's office.
3. The time required to mail the submittal or resubmittal back to Contractor shall not be considered a part of the submittal review period.
4. When the drawings and data are returned with review status "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer .
 - a. When submittals are made electronically, the corrected drawings and data shall be resubmitted through the Project website or via email.
 - b. Resubmittals by facsimile will not be accepted. When the drawings and data are returned with review status "EXCEPTIONS NOTED", "NO EXCEPTIONS NOTED", or "RECORD COPY", no additional copies need be furnished unless specifically requested by Engineer .

C. Resubmittal of Shop Drawings and Data.

1. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal. Resubmittals shall be in an organized and consistent format.
2. When corrected copies are resubmitted, Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for

Submittal Procedures

initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) or a unique identification that indicates the initial submittal and correct sequence of each resubmittal.

3. If more than one resubmittal is required because of failure of Contractor to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.
4. Resubmittals shall be made within 21 days of the date of the letter returning the material to be modified or corrected, unless within 7 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.
5. Resubmittals shall be made within 21 days of the date of the letter returning the material to be modified or corrected, unless within 7 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.
6. The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times 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.

1.2 OPERATION AND MAINTENANCE DATA AND MANUALS.

- A. Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a Project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.
- B. Unless otherwise agreed by Engineer, the operation and maintenance manual for each type of equipment shall only be submitted for review following completion of review of all shop drawings and engineering data pertaining to that equipment.
- C. Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.
- D. Operation and maintenance manuals shall include the following:
 1. Equipment function, normal operating characteristics, and limiting conditions.
 2. Assembly, installation, alignment, adjustment, and checking instructions.

Submittal Procedures

3. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 4. Lubrication and maintenance instructions.
 5. Guide to troubleshooting.
 6. Parts lists and predicted life of parts subject to wear.
 7. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.
 8. Test data and performance curves, where applicable.
- E. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by Contractor.
- F. Hard copy and Electronic Manuals
1. One electronic copy of each manual shall be submitted to Engineer prior to the date of shipment of the equipment.
 2. When the O&M manuals are returned with the review status "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer , and one complete corrected copy of the O&M manual returned to Engineer.
 3. After review by Engineer , is complete one hard and one electronic copy of each operation and maintenance manual shall be prepared and delivered to Engineer not later than 30 days prior to placing the equipment in operation. The electronic copy of the O&M manual shall be delivered on USB flash drive to Engineer.
 4. Procedures for submission of the electronic copy will be provided after award of the Contract.
 5. The completed O&M manual shall also be filed to the Project website or via email.
- G. All material shall be marked with Project identification, and inapplicable information shall be marked out or deleted.
- H. Shipment of equipment will not be considered complete until all required manuals and data have been received.
- I. Hard Copy Operation and Maintenance Manual Requirements.
1. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall be suitably identified on the outside.

Submittal Procedures

2. Each volume containing data for three or more items of equipment shall include a table of contents and index tabs.
3. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three-ring binders with heavy paper covers and include a table of contents and suitable index tabs.

J. Electronic Operation and Maintenance Manual Requirements.

1. Electronic manuals shall be in Adobe Acrobat's Portable Document Format (PDF), and shall be prepared at a resolution between 300 and 600 dots per inch (dpi), depending on document type.
2. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the "original image with hidden text" option in Adobe Acrobat Exchange.
3. File size shall be limited to 10 MB. A single PDF file greater than 25 MB may only be submitted if acceptable to Owner. When multiple files are required the least number of files possible shall be created.
4. File names shall be in the format OMXXXXXX-YYYZ-V.pdf, where XXXXX is the six digit number corresponding to the specification section, YYY is a three digit O&M manual number, e.g. 001, Z is the letter signifying a resubmittal, A, B, C, etc., and V is a number used only when more than one 25 MB file is required for an O&M manual.
5. Documents prepared in PDF format shall be processed as follows:
 - a. Pages shall be searchable (processed for optical character recognition) and indexed when multiple files are required.
 - b. Pages shall be rotated for viewing in proper orientation.
 - c. A bookmark shall be provided in the navigation frame for each entry in the Table of Contents.
 - d. Embedded thumbnails shall be generated for each completed PDF file.
 - e. The opening view for PDF files shall be as follows:
 - 1) Initial View: Bookmarks and Page
 - 2) Page Number: Title Page (usually Page 1)
 - 3) Magnification: Set to Fit in Window
 - 4) Page: Single Page
 - f. Where the bookmark structure is longer than one page the bookmarks shall be collapsed to show the chapter headings only.
 - g. When multiple files are required the first file of the series (the parent file) shall list every major topic in the Table of Contents. The parent file shall also include minor headings bookmarked based on the Table of Contents.

Submittal Procedures

Major headings, whose content is contained in subsequent files (children) shall be linked to be called from the parent to the specific location in the child file. The child file shall contain bookmark entries for both major and minor headings contained in the child file. The first bookmark of any child file shall link back to the parent file and shall read as follows "Return to the *Equipment Name* Table of Contents", e.g. Return to the Polymer Feed System Table of Contents.

- h. Drawings shall be bookmarked individually.
- i. Files shall be delivered without security settings to permit editing, insertion and deletion of material to update the manual provided by the manufacturer.

K. Labeling

- 1. As a minimum, the following information shall be included on all final O&M manual materials, including CD-ROM disks, jewel cases, and hard copy manuals:
 - a. Equipment name and/or O&M title spelled out in complete words.
 - b. Project Name.
 - c. Owner Project/Contract Number.
 - d. Specification Section Number. Example: "Section 01 15 00"
 - e. Manufacturer's name.
 - f. File Name and Date.

- 2. Label example:

Backwash Pump Operation and Maintenance Manual
Somewhere Plant Expansion
Project/Contract No. ____
Specification Section 01 15 00
Manufacturer
OM01 15 00-001.pdf, 5/05/23

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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SUBMITTAL No. _____

SECTION _____

Do not combine multiple sections together unless required by specifications.

(Contractor's Letterhead)

SUBMITTAL IDENTIFICATION & CONTRACTOR'S APPROVAL STATEMENT

DATE: _____ COPIES _____ DRAWING SHEET NO. _____

Description submittal contents: _____

Location: _____

Manufacturer _____

Subcontractor or Supplier (Optional) _____

REMARKS: _____

CONTRACTOR'S APPROVAL

(_____ Construction Company _____) has reviewed and coordinated the submitted documentation and verifies that the equipment and material meet the requirements of the Work and the Contract Documents. We accept sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data contained in the submittal as required by the Contract Documents.

Deviations: None Yes (See attached Figure 2- 01 33 00 for written description)

Approved By: _____ Date: _____

This approval does not release subcontractor / vendor from the contractual responsibilities.

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Abbreviations and Acronyms

Section 01 42 13 - ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 LIST OF ABBREVIATIONS.

- A. Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

| | |
|--------|---|
| AA | Aluminum Association |
| AABC | Associated Air Balance Council |
| AAMA | Architectural Aluminum Manufacturers Association |
| AASHTO | American Association of State Highway and Transportation Officials |
| ABMA | American Bearing Manufacturers Association |
| ACI | American Concrete Institute |
| ACPA | American Concrete Pipe Association |
| AEIC | Association of Edison Illuminating Companies |
| AFBMA | Antifriction Bearing Manufacturers Association now recognized as the ABMA |
| AFPA | American Forest & Paper Association |
| AGA | American Gas Association |
| AGMA | American Gear Manufacturers Association |
| AHA | American Hardboard Association |
| AHRI | Air-Conditioning, Heating and Refrigeration Institute |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AITC | American Institute of Timber Construction |

Abbreviations and Acronyms

| | |
|--------|--|
| AMCA | Air Movement and Control Association International |
| ANSI | American National Standards Institute |
| APA | Engineered Wood Association (formerly American Plywood Association) |
| API | American Petroleum Institute |
| AREMA | American Railway Engineers and Maintenance-of-Way Association |
| ASAHC | American Society of Architectural Hardware Consultants |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASSE | American Society of Sanitary Engineers |
| ASTM | ASTM International |
| AWG | American Wire Gauge |
| AWI | Architectural Woodwork Institute |
| AWPA | American Wood-Preservers' Association |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| BHMA | Builders Hardware Manufacturers Association |
| BIA | Brick Institute of America (formerly SCPI) |
| CDA | Copper Development Association |
| CISPI | Cast Iron Soil Pipe Institute |
| CMAA | Crane Manufacturers Association of America |
| CRA | California Redwood Association |

Abbreviations and Acronyms

| | |
|----------|---|
| CRSI | Concrete Reinforcing Steel Institute |
| CS | Commercial Standard (U.S. Department of Commerce) |
| DHI | Door and Hardware Institute |
| DIPRA | Ductile Iron Pipe Research Association |
| EEI | Edison Electric Institute |
| EJCDC | Engineers' Joint Contract Documents Committee |
| EPA | Environmental Protection Agency |
| FCC | Federal Communications Commission |
| FCI | Fluid Controls Institute |
| Fed Spec | Federal Specification |
| FGMA | Flat Glass Marketing Association |
| FHWA | Federal Highway Administration |
| FIA | Factory Insurance Association |
| FM | Factory Mutual |
| FSA | Fluid Sealing Association |
| HEI | Heat Exchange Institute |
| HMI | Hoist Manufacturers Institute |
| HPMA | Hardwood Plywood Manufacturers Association |
| HTI | Hand Tools Institute |
| I-B-R | Institute of Boiler and Radiator Manufacturers |

Abbreviations and Acronyms

| | |
|--------|--|
| IEEE | Institute of Electrical and Electronics Engineers |
| IBC | International Building Code |
| IES | Illuminating Engineering Society |
| IFI | Industrial Fasteners Institute |
| IPCEA | Insulated Power Cable Engineers Association |
| IRI | Industrial Risk Insurers |
| ISA | International Society of Automation |
| LEED | Leadership in Energy and Environmental Design |
| MHI | Materials Handling Institute |
| MIL | Military Specification |
| MMA | Monorail Manufacturers Association |
| MSS | Manufacturers Standardization Society of Valve and Fitting Industry |
| NAAMM | National Association of Architectural Metals Manufacturers |
| NACE | NACE International |
| NBBPVI | National Board of Boiler and Pressure Vessel Inspectors |
| NBS | See NIST |
| NCSPA | National Corrugated Steel Pipe Association |
| NEBB | National Environmental Balancing Bureau |
| NEC | National Electrical Code |
| NECA | National Electrical Contractors Association |
| NEII | National Elevator Industry, Inc. |

Abbreviations and Acronyms

| | |
|-------|--|
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| NIST | National Institute of Standards and Technology (formerly NBS) |
| NLA | National Lime Association |
| NPC | National Plumbing Code |
| NPT | National Pipe Thread |
| NRMCA | National Ready Mixed Concrete Association |
| NSC | National Safety Council |
| NSF | NSF International (formerly National Sanitation Foundation) |
| NTMA | National Terrazzo and Mosaic Association |
| NWMA | National Woodwork Manufacturers Association |
| OSHA | Occupational Safety and Health Administration |
| PCA | Portland Cement Association |
| PCI | Precast/Prestressed Concrete Institute |
| PS | Product Standard |
| RIS | Redwood Inspection Service |
| SAE | SAE International |
| SDI | Steel Door Institute |
| SFPA | Southern Forest Products Association |
| SI | Système International des Unités (International System of Units) |
| SIGMA | Sealed Insulating Glass Manufacturers Association |

Abbreviations and Acronyms

| | |
|--------|---|
| SJI | Steel Joist Institute |
| SMA | Screen Manufacturers Association |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| SPFA | Steel Plate Fabricators Association |
| SPI | Society of the Plastics Industry |
| SPTA | Southern Pressure Treaters Association |
| SSFI | Scaffolding, Shoring & Forming Institute, Inc |
| SSPC | SSPC: The Society for Protective Coatings |
| TABB | Testing, Adjusting, and Balancing Bureau |
| UL | Underwriters' Laboratories |
| USBR | U.S. Bureau of Reclamation |
| USGBC | U.S. Green Building Council |
| WEF | Water Environment Federation |

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Quality Control

SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.1 TESTING SERVICES.

- A. Testing services shall be provided in accordance with Paragraph 14.02 of the General Conditions. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer and/or Authority Having Jurisdiction excluding testing as specified to be conducted directly by Contractor. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.
- B. Testing services provided by Owner are for the sole benefit of Owner and/or as required by the governing building code; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.
- C. Testing Services Provided by Contractor.
 - 1. Unless otherwise specified, Contractor shall provide all testing services in connection with the following:
 - a. Any Work or part thereof specifically to be inspected, tested or approved by an employee or representative of an Authority Having Jurisdiction. Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals. Contractor shall pay all costs associated for these activities and shall provide the required certificates of inspection or approval.
 - b. Any inspections, tests or approvals required for Owner or Engineer acceptance of materials or equipment to be incorporated in the Work. This includes any items required for acceptance of materials, concrete mix designs or equipment submitted for approval prior to Contractor's purchase for incorporation in the Work.
 - c. Testing, adjusting and balancing of mechanical, electrical and other equipment and systems as specified to be incorporated into the Work. This includes services required by manufacturers of equipment or other products such as concrete repair products, pipe, coatings, linings and roof membranes furnished under the Contract Documents.
 - d. Tightness testing of containment structures and pressure or leakage testing of piping as specified.
 - e. Any Work (or part thereof) required by the Contract Documents to be approved by Owner, Engineer or other designated individual or entity. Contractor shall assume full responsibility for arranging and obtaining such approvals, pay all costs in connection therewith and submit to Engineer the required certificates of approval.

Quality Control

2. Excluding those conducted directly by an Authority Having Jurisdiction or expressly specified to be conducted directly by Contractor, inspections and tests shall be performed by independent inspectors, approved agencies or other qualified individuals or entities acceptable to Owner and .
- D. Contractor shall provide access to the site and Work in accordance with 14.01 and 14.02 of the General Conditions. Contractor shall give timely notice of the readiness of the Work for inspection, tests or approvals and shall cooperate with the inspection and testing personnel to facilitate the required tests and inspections. Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no Claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or Agency personnel, Contractor shall furnish personnel and facilities to assist in the activities as required.
- E. Transmittal of Test Reports.
1. Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
 2. The Approved Agency retained by Contractor shall furnish five copies of a written report of each test. Two copies of each test report will be transmitted to the Resident Project Representative, one copy to the Special Inspector, one copy to Engineer, and one copy to Contractor, within 3 days after each test is completed or as directed by the Statement of Special Inspections as applicable.
- 1.2 OFFSITE INSPECTION
- A. If needed, any offsite inspection is outlined in the equipment specific specification.
- 1.3 MANUFACTURER'S FIELD SERVICES
- A. Manufacturer's field services shall be as specified herein except as specifically specified in the respective equipment sections.
- B. Services Furnished Under This Contract. An experienced, competent, and authorized representative of the manufacturer of each item of equipment for which field services are indicated in the respective equipment section or in the equipment schedule section shall visit the Site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.
- C. Each manufacturer's representative shall furnish to Owner, through Engineer, a written report certifying that the equipment has been properly installed and lubricated; is in

Quality Control

accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

- D. All costs for these services shall be included in the Contract Price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Temporary Facilities and Controls

Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 UNITS OF MEASUREMENT.

- A. When both inch-pound (English) and SI (metric) units of measurement are specified herein, the values expressed in inch-pound units shall govern.

1.2 COORDINATION WITH OTHER WORK.

- A. A separate project is expected to be underway on site at the same time. Contractor shall not hinder other activities onsite and must coordinate with the other Contractor and Owner, as needed.

1.3 OFFICE AT SITE OF WORK.

- A. During the performance of this Contract, Contractor shall maintain a suitable office at or near the Site which shall be the headquarters of its representative authorized to receive drawings, instructions, or other communication or articles.
- B. A trailer is permitted on site and can be located where storage of materials or Contractor parking is outlined on the drawings.
- C. Any communication given to the said representative or delivered at Contractor's office at the Site in the representative's absence shall be deemed to have been delivered to Contractor.
- D. Copies of the Drawings, Specifications, and other Contract Documents shall be kept at Contractor's office at the Site and available for use at all times.
- E. Locate the offices and other Contractor facilities to limit site disturbance as specified in the Project Requirements section.

1.4 POTABLE WATER.

- A. All potable water required for and in connection with the Work to be performed shall be provided by and at the expense of Contractor. No separate payment for potable water used or required will be made and all costs in connection therewith shall be included in the Bid.

Temporary Facilities and Controls

1.5 NON-POTABLE WATER.

- A. All non-potable water required for and in connection with the Work to be performed shall be furnished by and at the expense of Contractor through meters installed on hydrants. Contractor shall supply all necessary tools, hose, and pipe, or otherwise transport the non-potable water to the point of use, and shall make its own arrangements with the Ann Arbor Township as to the amount of water required and the time when the water will be needed. Indiscriminate use of water so furnished will not be permitted. Special hydrant wrenches shall be used for opening and closing fire hydrants. In no case shall pipe wrenches be used for this purpose.

1.6 POWER.

- A. Power for heating, lighting, and operation of Contractor's equipment in connection with the Work to be done under this Contract can be provided by Owner without charge to Contractor, subject to the following conditions:
1. Existing lighting systems at the UV area may be utilized by Contractor to the extent available. Any necessary additional or temporary lighting systems shall be provided by Contractor at no additional cost to Owner.
 2. Power will be available at existing power panels and can be discussed further at the Pre-construction meeting.
 3. Power will be available at:
 - a. 120 volts, 60 Hz, single phase
 4. With approval by the Owner, Contractor, at its own expense, shall make authorized connections to the existing power sources and shall extend temporary service lines to the required areas. Temporary wiring shall conform to Article 590 of the NEC.
 5. Contractor shall at all times provide adequately against waste and needless use of power. Electrical power shall be used only in such quantities as will not interfere with Owner's requirements, and care shall be taken not to overload the existing facilities. Contractor shall provide any additional or temporary electrical power or power of other voltages it may require for completion of the Work.
- B. These provisions shall not be construed as a guarantee by Owner of the uninterrupted continuation of power, and interruptions beyond the control of Owner shall not be reason for claims for additional costs nor for extensions of time. Contractor shall provide, at no additional cost to Owner, any necessary power required for prosecution of the Work during such interruptions.

Temporary Facilities and Controls

1.7 SANITARY FACILITIES.

- A. Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.
- B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

1.8 MAINTENANCE OF TRAFFIC.

- A. Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.
- B. In making open-cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

1.9 BARRICADES AND LIGHTS.

- A. All roads which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest street on each side of the blocked section.
- B. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.
- C. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside roads shall cause the minimum obstruction and inconvenience.
- D. All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements.

Temporary Facilities and Controls

1.10 FENCES.

- A. All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.
- B. On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original locations.

1.11 PROTECTION OF PUBLIC AND PRIVATE PROPERTY.

- A. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.
- B. No trees shall be removed outside the permanent easement, except where authorized by Engineer. Whenever practicable, Contractor shall tunnel beneath trees in yards and parkings when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage from construction operations.
- C. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor or its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.
- D. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

1.12 DAMAGE TO EXISTING PROPERTY.

- A. Contractor will be held responsible for any damage to existing structures, Work, materials, or equipment because of his operations and shall repair or replace any

Temporary Facilities and Controls

damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, Owner.

- B. Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.
- C. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or workers to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1.13 TREE AND PLANT PROTECTION.

- A. All trees and other vegetation which must be removed to perform the Work shall be removed and disposed of by Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the Drawings. All trees and plants not removed shall be protected against injury from construction operations.
- B. Trees considered by Engineer or Owner to have any significant effect on construction operations are indicated on the Drawings and those which are to be preserved are so indicated.
- C. Contractor shall take extra measures to protect trees designated to be preserved, such as erecting barricades, trimming to prevent damage from construction equipment, and installing pipe and other Work by means of hand excavation or tunneling methods. Such trees shall not be endangered by stockpiling excavated material or storing equipment against their trunks.
- D. When injuring or removal of trees designated to be preserved cannot be avoided, or when removal and replacement is indicated on the Drawings, each tree injured beyond repair or removed shall be replaced with a similar tree of the nearest size possible.
- E. All trimming, repair, and replacement of trees and plants shall be performed by qualified nurserymen or horticulturists.

1.14 SECURITY.

- A. Contractor shall be responsible for protection of the Site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.
- B. No Claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall make good all damage to Owner's property resulting from Contractor's failure to provide security measures as specified.

Temporary Facilities and Controls

- C. Security measures shall be at least equal to those usually provided by Owner to protect Owner's existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the Site.

1.15 PARKING.

- A. Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities.

1.16 NOISE CONTROL.

- A. Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.
- B. During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct its operations to avoid unnecessary noise which might interfere with the activities of building occupants.
- C. All activities on site must be conducted within the timeframe and sound levels as specified in the City of Ann Arbor's noise ordinance, Chapter 119 – Noise Control.

1.17 DUST CONTROL.

- A. Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.
- B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.18 TEMPORARY DRAINAGE PROVISIONS.

- A. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

Temporary Facilities and Controls

- B. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

1.19 EROSION CONTROL.

- A. Contractor shall prevent erosion of soil on the Site and adjacent property resulting from its construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.
- B. Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

1.20 POLLUTION CONTROL.

- A. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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General Equipment Stipulations

Section 01 61 00 - GENERAL EQUIPMENT STIPULATIONS

PART 1 - GENERAL

1.1 SCOPE.

- A. When an equipment specification section in this Contract references this section, the equipment shall conform to the general stipulations set forth in this section, except as otherwise specified in other sections.

1.2 COORDINATION.

- A. Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Drawings or Specifications.

1.3 MANUFACTURER'S EXPERIENCE.

- A. Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

1.4 WORKMANSHIP AND MATERIALS.

- A. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.
- B. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

General Equipment Stipulations

1.5 STRUCTURAL DESIGN REQUIREMENTS.

- A. All equipment, including non-structural components and non-building structures as defined in ASCE 7, and their anchorage, shall be designed and detailed in accordance with the Contract Drawings.

1.6 LUBRICATION.

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.
- B. Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantities to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Lubricants for equipment where the lubricants may come in contact with water before or during a potable water treatment process or with potable water, shall be food grade lubricants. This includes lubricants for equipment not normally in contact with water, but where accidental leakage of the lubricants may contaminate the water.
- C. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

1.7 ELEVATION.

- A. The elevation of the site shall be as indicated in the the Contract Drawings. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at the specified elevation.

1.8 ELECTRIC MOTORS.

- A. Unless otherwise specified, motors furnished with equipment shall meet the requirements specified in Common Motor Requirements for Process Equipment section or specified in specific equipment sections.

1.9 DRIVE UNITS.

- A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hour continuous service.

General Equipment Stipulations

- B. Gearmotors.
 - 1. The use of gearmotors sharing an integral housing or cutgears into the motor output shaft, or that require removal of lubricant from the gear reducer to change out the motor will not be acceptable.
- C. Gear Reducers.
 - 1. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated, rolling element, antifriction bearings throughout.
- D. Unless superseded by individual specification requirements each helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Cycloidal gear reducers shall have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class III. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall be designed and manufactured in compliance with applicable most current AGMA standards, except the L₁₀ bearing life shall be 200, 000 hours.
- E. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F .
- F. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable in large sized reducers. In small reducers, similar to basin equipment, permanently sealed grease lubricated bearings rated L₁₀ 200,000 hour life may be provided at the manufacturer's option. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or a sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.
- G. Gear reducers which require the removal of parts or the periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
- H. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.
- I. Adjustable Speed Drives.
 - 1. Each mechanical adjustable speed drive shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor. A spare belt shall be provided with each adjustable speed drive unit employing a

General Equipment Stipulations

belt for speed change. Unless specifically permitted by the detailed equipment specifications, bracket type mounting will not be acceptable for variable speed drives.

J. V-Belt Drives.

1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor.

1.10 SAFETY GUARDS.

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage thick or thicker galvanized, aluminum-clad sheet steel, or stainless sheet steel or from 1/2 inch mesh galvanized expanded metal, or pultrusion molded UV resistant materials. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

1.11 ANCHOR BOLTS.

- A. Equipment suppliers shall design and detail suitable anchor bolts for each item of equipment. Anchor bolts shall be designed for all operating conditions of the equipment, including wind and seismic loadings when applicable. Wind and seismic loads shall be as indicated in the Contract Drawings.
- B. Contractor shall furnish anchor bolts under the construction contract and be responsible for coordination with equipment suppliers for correct design and details.
- C. Requirements for anchor bolt type, material, and minimum diameter shall be as indicated in the Post Installed Anchors section.
- D. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete or masonry grout is placed.
- E. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

General Equipment Stipulations

1.12 EQUIPMENT BASES.

- A. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches . Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components, and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in the Grouting section.

1.13 SPECIAL TOOLS AND ACCESSORIES.

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.14 SHOP PAINTING.

- A. All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.
- B. Surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer.
- C. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer.

1.15 PREPARATION FOR SHIPMENT.

- A. Equipment shall be prepared for shipment as specified in the Product Delivery Requirements section.

General Equipment Stipulations

1.16 STORAGE.

- A. Handling and storage of equipment shall be as specified in the Product Storage and Handling Requirements section.

1.17 INSTALLATION AND OPERATION.

- A. Installation and operation shall be as specified in respective equipment sections and the Commissioning section.
- B. Unless otherwise indicated in other sections, installation and operation/startup is by the General Contractor under a separate contract. Any specific work or installation assistance from the UVSS is outlined in other sections.

1.18 OBSERVATION OF PERFORMANCE TESTS.

- A. Where the Specifications require the presence of Engineer, initial tests shall be observed or witnessed by Engineer. Owner shall be reimbursed by Contractor for all costs of subsequent visits by Engineer to witness or observe incomplete tests, retesting, or subsequent tests.

1.19 PROGRAMMING SOFTWARE.

- A. Programming software shall be provided for any equipment which includes a programmable logic controller (PLC) or other digital controller that is user-programmable.
- B. The software shall be suitable for loading and running on a laptop personal computer operating with a Windows-based operating system.
- C. A copy of the manufacturer's original operating logic program shall be provided for use in maintaining and troubleshooting the equipment.
- D. Where multiple pieces of equipment, from the same or different vendors, use the same programming software, only one copy of the software need be provided.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Product Delivery Requirements

Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers packaging and shipping of materials and equipment.
- B. Costs to comply with this section are to be included in the Balance of the Work.

1.2 PREPARATION FOR SHIPMENT.

- A. All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.
- B. Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.
- C. Grease and lubricating oil shall be applied to all bearings and similar items.

1.3 SHIPPING.

- A. Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Product Storage and Handling Requirements

Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers delivery, storage, and handling of materials and equipment.
- B. Costs to comply with this section are to be included in the Balance of the Work.
- C. The UVSS is only responsible for shipment to site and coordination of shipping dates with the Contractor. Unloading and storage will be by the Contractor.

1.2 DELIVERY.

- A. Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the Site.
- B. Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.
- C. All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.
- D. Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

1.3 STORAGE.

- A. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.
- B. Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Masonry products shall be

Product Storage and Handling Requirements

handled and stored in a manner to hold breakage, chipping, cracking, and spalling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

- C. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Electrical equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.
- D. Equipment having moving parts, such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer. Manufacturer's storage instructions shall be carefully followed by Contractor.
- E. When required by the equipment manufacturer, moving parts shall be rotated a minimum of twice a month to ensure proper lubrication and to avoid metal to metal "welding". Upon installation of the equipment, Contractor shall, at the discretion of Engineer, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
- F. When required by the equipment manufacturer, lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment by Contractor at the time of acceptance.
- G. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.
- H. In addition to the protection specified for prolonged storage, the packaging of spare units and spare parts shall be for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.

1.4 HANDLING.

- A. Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.
- B. During handling, carbon steel constructed material including chains, straps, and forks on lifting equipment shall not directly contact any equipment or material constructed of stainless steel. It shall be the Contractor's responsibility to correct any carbon steel contamination of stainless steel.

Product Storage and Handling Requirements

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Equipment and Valve Identification

Section 01 68 00 - EQUIPMENT AND VALVE IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers the furnishing and installation of nameplates and tags for identification of equipment, valves, panels, and instruments.

1.2 GENERAL.

- A. Except as otherwise specified in equipment, valve, and instrumentation sections, nameplates and tags shall be as specified herein. Nameplates or tags shall be provided for all equipment, valves, operator interfaces, control and electrical panels, cabinets, instruments, and instrument racks that have been named and/or tagged on the Drawings.

1.3 SUBMITTALS.

- A. Drawings and Data
 - 1. Drawings and data shall be submitted in accordance with the requirements of the Submittals Procedures section for each type of tag provided including materials, colors, sizes, letter sizes, and installation instructions.

PART 2 - PRODUCTS

2.1 EQUIPMENT NUMBER PLATES.

- A. All equipment tagged on the drawings, except for submerged equipment shall be provided with number plates bearing the equipment tag number identified on the Drawings.
- B. Number plates shall be bevelled, 1/8th inch thick laminated black phenolic plastic engraving stock with white core. Lettering on number plates shall be capitalized block letters $\frac{3}{4}$ inch high.
- C. Number plate height shall be twice the letter height. Number plate length shall be as needed, with suitable margins all around.
- D. Lettering shall be placed in one row where practicable; however, where necessary due to excessive length, lettering shall be placed on more than one row and centered.

Equipment and Valve Identification

- E. Number plates shall be attached with stainless steel panhead screws, rivets, or drive screws.
- F. When a number plate cannot be installed due to the physical size, space, or mounting surface geometry of the equipment, the Contractor shall provide a 12 gauge stainless steel tag with engraved or imprinted equipment tag number. Lettering on tags shall be ¼ inch high. Tags shall be rectangular with smooth edges and shall be fastened to the equipment with stainless steel mechanical fasteners or with a stainless steel chain.

2.2 EQUIPMENT INFORMATION PLATES.

- A. Equipment shall be provided with engraved or stamped equipment information plates securely affixed with mechanical fasteners to the equipment in an accessible and visible location.
- B. Equipment information plates shall be in addition to the number plates specified.
- C. Equipment information plates shall indicate the manufacturer's name, address, product name, catalog number, serial number, capacity, operating and power characteristics, labels of tested compliances, and any other pertinent design data.
- D. Equipment information plates listing the distributing agent only will not be acceptable.

2.3 VALVE AND GATE TAGS.

- A. Temporary Tags.
 - 1. Each valve and gate with an identifying number indicated on the Drawings or listed in the valve or gate schedule, shall be tagged or marked in the factory with the identifying number.
- B. Permanent Tags.
 - 1. All valves and gates, except buried or submerged valves, that have been assigned a number on the Drawings or in the valve or gate schedule, shall be provided with a permanent number plate.
 - 2. Tags shall be permanently attached to valves and gates with stainless steel mechanical fasteners or with stainless steel chains. Numerals shall be ¾ inch 20 mm high and shall be black baked enamel on an anodized aluminum plate.
- C. All buried valves shall be tagged with a brass plate cast into a 6-inch by 6 inch concrete pad at grade next to the valve box. The valve number shall be engraved in the brass plate with lettering and numerals at least 1 inch high.

Equipment and Valve Identification

2.4 PANEL NAMEPLATES.

- A. Nameplates shall be provided on the face of each panel and cabinet. Panel identification nameplates shall be mounted at the top of the panel shall include the panel descriptive name and tag number as indicated on the Drawings, in two or three lines of text. Lettering shall be $\frac{3}{4}$ inch high.
- B. Nameplates for devices mounted on or in the panel shall be inscribed with the text as indicated on the Drawings. Where nameplate information is not indicated on the Drawings, inscriptions shall be in accordance with information in the supplier's submittal drawings as guided by information in the relevant specification section. Panel device nameplates shall have engraved letters $\frac{3}{16}$ inch high.
- C. Nameplate material and size shall be as specified above for equipment number plates. Nameplates shall be secured to the panel with stainless steel panhead screws.

2.5 INSTRUMENT TAGS.

- A. Temporary Tags.
 - 1. Where instruments are not provided with permanent tags furnished from the factory, instruments shall be tagged or marked in the factory with the instrument tag number indicated on the Drawings.
- B. Permanent Tags.
 - 1. Instruments shall be tagged with the instrument tag number indicated on the Drawings. Tags shall be 12 gauge stainless steel with engraved or imprinted symbols. Lettering on tags shall be $\frac{1}{4}$ inch high. Tags shall be rectangular with smooth edges, and shall be fastened to the instrument with stainless steel mechanical fasteners or with a stainless steel chain.

PART 3 - EXECUTION (NOT USED)

End of Section

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Equipment Installation

Section 01 73 19 - EQUIPMENT INSTALLATION

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers general installation requirements of new equipment units that have been purchased by Contractor as part of this Work, or equipment that has begun the procurement process by others under separate equipment procurement specifications. Equipment specific installation requirements are covered in the equipment sections.
- B. The procurement process has already begun for the following pieces of equipment by others for final procurement and installation by Contractor:
 - 1. Ultraviolet (UV) disinfection system.

1.2 GENERAL.

- A. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. Any equipment identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment has been purchased are available.
- C. Coordination.
 - 1. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services furnished by others.
 - 2. Submittals for equipment furnished by others under each procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.
 - 3. Flanged connections to equipment including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.

Equipment Installation

1.3 DELIVERY, STORAGE, AND HANDLING.

A. Storage.

1. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with the Product Storage and Handling Requirements section until installed in the Work.
2. Equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on or come into contact with the ground, grass, or any other type of vegetation.
3. Contractor shall keep the equipment dry at all times

PART 2 - PRODUCTS

2.1 MATERIALS.

A. Materials shall be as follows:

1. Grout: As specified in the Grouting section.
2. Anti-Seize thread lubricant for SS bolts: As specified in the Post Installed Anchors section.

PART 3 - EXECUTION

3.1 INSTALLATION.

- A. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results as specified in the Commissioning section.
- B. Each equipment unit shall be leveled, aligned, and shimmed into position. Installation procedures shall be as recommended by the equipment manufacturer and as required herein. Shimming between machined surfaces will not be permitted.
- C. Anti-seize thread lubricant shall be liberally applied to the threaded portion of all stainless steel bolts during assembly. For equipment installed in drinking water facilities, the anti-seize lubricant shall meet requirements of NSF-61.
- D. When specified in the equipment sections, the equipment manufacturer will provide installation supervision and installation checks. For installation supervision, the manufacturer's field representative will observe, instruct, guide, and direct Contractor's erection or installation procedures as specified in the equipment specifications. For

Equipment Installation

installation checks, the manufacturer's field representative will inspect the equipment installation immediately following installation by Contractor, and observe the tests indicated in the Commissioning section. The manufacturer's representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

- E. All equipment shall be protected after installation, prior to final acceptance by Owner. Protection provisions shall be as recommended by the manufacturer, and shall include provisions to prevent rust, mechanical damage, and foreign objects entering the equipment.

3.2 STARTUP AND TESTING.

- A. Startup requirements, and tests associated with startup shall be as indicated in the Commissioning section. Other field tests shall be as indicated in the specific equipment sections. Startup and tests required shall occur in the order listed in the following paragraphs. Tests shall not begin until any installation supervision and installation checks by the equipment manufacturer have been completed, except where noted below.

- B. Preliminary Field Tests.

- 1. Preliminary field tests shall be conducted on all equipment by Contractor as indicated in the Commissioning section. When an installation check is specified in the equipment sections, the equipment manufacturer's representative will participate in these tests to the extent described in the Commissioning section and in the equipment sections.

- C. Field System Operation Tests.

- 1. Field system operation tests shall be conducted on all equipment by Contractor as indicated in the Commissioning section. When an installation check is specified in the equipment sections, the equipment manufacturer's service personnel will participate in these tests to the extent described in the Commissioning section and in the equipment sections.

- D. Field Demonstration Tests.

- 1. Field demonstration tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

- E. Field Performance Tests & Distribution Tests.

- 1. Field performance tests or distribution tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

- F. Field Baseline Performance Tests.

Equipment Installation

1. Field baseline performance tests shall be conducted by Contractor on the equipment indicated in the equipment sections, and the tests shall be performed as indicated. When indicated in the equipment sections, the equipment manufacturer will participate in these tests. This test shall not be considered an acceptance test, but rather a test to determine initial performance curves and efficiency just prior to the equipment entering service.

End of Section

Closeout Procedures

Section 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUBSTANTIAL COMPLETION PROCEDURES.

- A. Procedures for achieving Substantial Completion on the Project shall be as indicated below.
- B. Contractor's List of Incomplete Items:
 - 1. Contractor shall prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- C. Submittals
 - 1. General.
 - a. Prior to Substantial Completion: Contractor shall complete the submittals listed in this section a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion.
 - 2. Certificates of Release
 - a. Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 3. Division 00 and 01 Closeout Submittals
 - a. Submit closeout submittals specified in other Division 00 of Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 4. Other Closeout Submittals
 - a. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 5. Maintenance Material Submittals
 - a. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver

Closeout Procedures

to location designated by Engineer. Label with manufacturer's name and model number.

6. Schedule of Maintenance Material Items
 - a. Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
7. Testing, adjusting, and balancing records.
8. Sustainable design submittals not previously submitted.
9. Changeover Information
 - a. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

1.2 Procedures

- A. Prior to Substantial Completion: Contractor shall complete the following activities a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion:
 1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified elsewhere.
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.

Closeout Procedures

10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3 Inspection

- A. Contractor shall submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests.
- B. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
- C. Contractor shall request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- D. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION PROCEDURES.

- A. Procedures for achieving Final Completion on the Project shall be as indicated below.
- B. Submittals
 1. General
 - a. Prior to Final Completion: Contractor shall submit the following to Engineering before requesting final inspection for determining final completion:
 2. Final Application for Payment
 - a. Submit a final Application for Payment according to Section 01 29 76 "Progress Payment Procedures."
 3. List of Incomplete Items
 - a. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

Closeout Procedures

4. Certificate of Insurance
 - a. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
5. Final completion photographic documentation.

1.5 Inspection

- A. Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- B. Contractor shall request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 SUBMITTAL OF PROJECT WARRANTIES.

A. Submittals

1. General.
 - a. Project Warranty information and documentation shall be submitted as indicated in the Division 00 Sections and as indicated below.
 - b. Contractor shall submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
 - c. Partial Occupancy: Contractor shall submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
2. Warranty Documentation
 - a. Contractor shall organize warranty documents into an orderly sequence based on the table of contents of Project Specifications.
 - b. Where warranty documentation is electronic, Contractor shall submit warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

Closeout Procedures

- c. Where warranty documentation is in hard copy format, Contractor shall submit warranties and bonds as follows:
 - 1) Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 - 2) Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3) Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

1.7 FINAL CLEANING AND REPAIR OF WORK.

- A. In addition to any specific cleaning or repair work identified in Lists of Incomplete Items for Substantial Completion or Final Completion, Contractor shall perform the following general final cleaning and repair of work:
 - 1. General
 - a. Contractor shall perform final and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
 - 2. Cleaning
 - a. Contractor shall employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 3. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.

Closeout Procedures

- e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- B. Construction Waste Disposal:
- 1. Contractor shall complete all work and submit documentation to show compliance with waste disposal requirements.
- C. Repair and Restoration Work
- 1. Contractor shall complete repair and restoration work before requesting inspection for determination of Substantial Completion.
 - 2. Contractor shall repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore

Closeout Procedures

damaged construction and permanent facilities used during construction to specified condition.

3. Contractor shall remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
4. Contractor shall touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
5. Contractor shall replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Demonstration and Training

Section 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION.

- A. This section contains requirements for training the Owner's personnel in the proper operation and maintenance of the equipment and systems installed under this contract.

1.2 GENERAL.

- A. Where indicated in the Equipment Schedule section and as required by the specifications, the manufacturer's representative shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

1.3 SUBMITTALS.

- A. General
 - 1. Costs to comply with this section are to be included in the Balance of the Work and as indicated in the Bid Form.
 - 2. The following information shall be submitted to the Engineer in accordance with the provisions of the Submittals Procedures section. The material shall be submitted not less than 4 weeks prior to the provision of training.
 - 3. Lesson plans, training manuals, handouts, visual aids, and other reference materials for each training session to be conducted by the manufacturer's representatives.
 - 4. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.

PART 2 - PRODUCTS

2.1 GENERAL.

- A. Where specified, the Contractor shall conduct training sessions for the Owner's personnel to instruct staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs.

Demonstration and Training

Approved operation and maintenance manuals shall be available at least 30 days prior to the date schedule for the individual training session.

2.2 LOCATION.

- A. Training sessions shall take place at the site of the work at a location designated by the Owner.

2.3 LESSON PLANS.

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of the visual aids to be utilized during the sessions. Each plan shall contain time allocation for each subject.
- B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids and reference materials shall be the property of the Owner and shall be suitable bound for proper organization and easy reproduction. The Contractor shall furnish up to twenty copies of necessary training manuals, handouts, visual aids, and reference materials at least 1 week prior to each training session.

2.4 FORMAT AND CONTENT.

- A. Each training session shall include classroom and time at the location of the subject equipment or system. As a minimum, training sessions shall cover the following subjects for each item of equipment or system:
 - 1. Familiarization
 - a. Review catalog, parts lists, drawings, etc, which have been previously provided for the plan files and operation and maintenance manuals.
 - b. Guided inspection of the subject equipment.
 - c. Demonstration of the subject equipment and how operation in accordance with the specified requirements.
 - 2. Safety
 - a. Review and demonstration of safety procedures and related documentation.
 - b. Inspection and discussion of hazardous components of the subject equipment.
 - 3. Operation
 - a. Review of subject equipment operations literature and theory of operation.
 - b. Overview of equipment operation and function.

Demonstration and Training

- c. Explanation and demonstration of all modes of operation including start up, shut down, normal, and emergency operation, and manual and automatic operation through the plant control system.
 - d. Explanation of all hardwired interlocks.
 - e. Explanation and demonstration of equipment related valves and their purpose.
 - f. Explanation of all equipment related instruments including primary element, instrument indicator, purpose, and interpretation of information.
 - g. Check out of Owner's personnel on proper use of the equipment.
4. Preventive maintenance
 - a. Review preventative maintenance documentation and discussion of maintenance require at various intervals; e.g. daily, weekly, monthly, annually.
 - b. Demonstrate performance of each preventive maintenance task.
 - c. Identification of indicators of equipment problems.
 - d. Discussion of corrosion protection and lubrication requirements.
 - e. Requirements for periodic exercise of equipment and demonstration of equipment exercise where required.
 - f. Identification of inspection points and demonstration of inspection covers removal and routine disassembly and assembly of equipment.
5. Corrective Maintenance and Equipment Repair
 - a. Discussion of common repairs and identification of special problems.
 - b. Explanation and demonstration of equipment inspection and troubleshooting.
 - c. Demonstration of calibration procedures.
 - d. Demonstration of repair procedures where practical.
6. Parts
 - a. Discussion of the parts list and ordering of parts.
 - b. Review of spare parts provided with the equipment and identification of other recommended spare part.
7. Local Representatives
 - a. Name, address, telephone of local representative.
 - b. Review of contact information for providers of routine and emergency repair and operational assistance.
8. Operation and Maintenance Manuals
 - a. Review of O&M manual content and organization.
 - b. Update O&M material as required.

Demonstration and Training

2.5 VIDEO RECORDING.

- A. The Contractor shall record each training session and shall give the Owner exclusive rights to each training session recording. The Contractor shall advise all manufacturers providing training sessions that the material will be recorded.

PART 3 - EXECUTION

3.1 General

- A. Two separate training sessions to accommodate work shifts, and shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled so that training is performed when equipment is available for operation. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 6 hours of class scheduled for any one day. Concurrent classes will not be permitted.

End of Section

Commissioning

Section 01 91 00 - Commissioning

PART 1 - GENERAL

1.1 SCOPE.

- A. The UVSS shall support commissioning requirements outlined herein and include costs in the Balance of Work.
- B. This section includes the requirements for startup and testing all items of equipment and systems that form a part of this Contract.
- C. The purpose of this section is to define the requirements for bringing individual equipment, systems, and facilities online and for proving proper operation and performance of that Work.
- D. Contractor is required to develop, submit, and maintain detailed plans, including designation of management and staff, for these activities as specified herein.
- E. Additional requirements such as training are specified in other sections.
- F. The Contractor will be required to startup, test, and commission equipment preselected by the Owner. Accepted shop drawings and UVSS scope of services are provided in Attachment A and B, respectively. The Contractor shall refer to these and coordinate with the Supplier of the equipment regarding startup and testing activities.
- G. The startup, testing, and commissioning services referenced or specified herein include the following:
 - 1. Startup and Testing
 - a. Startup checks
 - b. Functional testing
 - 2. Functional acceptance testing
 - 3. Commissioning
 - 4. Operation acceptance testing
 - 5. Performance testing
- H. Definitions.
 - 1. Startup and Testing is the transitional phase between completion of construction and start of commissioning and includes the following:

Commissioning

- a. Pre-Startup Activities and Checks - Inspections, tests and other activities necessary to determine that equipment, systems and subsystems have been properly manufactured and installed. Pre-startup activities shall include an audit of all factory testing of equipment and compiling the results for comparison to startup and commissioning testing.
- b. Functional Testing – Initial limited operation of equipment, to demonstrate capability of installed components to perform their intended functions, respond to controls, and safely interface with external systems, followed by operation of individual systems in manual and automatic mode to test full functionality of individual systems.
- c. Commissioning - The establishment of the treatment processes for the plant.
- d. Operational acceptance testing - Continuous testing of complete the treatment processes under specified operating conditions in accordance with the technical Specifications and applicable regulations to demonstrate proper performance of the facility.
- e. Performance testing - When specified, continuous testing in accordance with the requirements of the Contract Documents.

1.2 GENERAL.

- A. The Contractor shall be responsible for and furnish all labor, materials, instruments, incidentals, and equipment required for startup, testing, and commissioning.
- B. Temporary facilities required to carry out the specified testing, including temporary pipe, pumps, and other appurtenances, shall be furnished and installed, and removed when no longer required for startup, testing, and commissioning. Refer to the Temporary Facilities section for requirements concerning water and power for startup and testing.
- C. Chemicals required for startup and testing shall be provided by the Contractor except as otherwise specified herein.
- D. Wastewater, including treated or test water that cannot be delivered to the plant effluent for any reason, shall be disposed of at the expense of the Contractor, in a manner acceptable to the Owner, and in accordance with all laws, regulations, and permits.
- E. Startup and testing shall be conducted during normal working hours during the workweek of Monday through Friday, unless otherwise approved by the Owner.
- F. Where continuous long-term testing is required, testing may continue over the weekends and holidays with prior approval from the Owner.

1.3 CONSTRAINTS.

- A. Startup and testing shall be conducted in a manner that does not compromise operation of the existing facilities or the quality of treated products released from the facility.

Commissioning

- B. Any startup and testing activities affecting operation of the existing facilities shall be coordinated with the Owner and shall be shown on the Progress Schedule. The Owner will cooperate with the Contractor to the extent possible, but will have sole authority in decisions affecting existing operations.

1.4 STARTUP MANAGER, STARTUP TEAM, AND MANUFACTURER'S FIELD SERVICES REPRESENTATIVES.

- A. The Contractor shall maintain a dedicated startup team led by a startup manager. The individual to be designated as startup manager shall be identified within 45 days of the Notice to Proceed and will be reviewed by Owner and Engineer. Once accepted, the Contractor shall not change the startup manager throughout the full period of performance of the Work without written permission of the Owner. Once engaged in the Project, the startup manager shall attend regular construction progress meetings. No startup activities shall begin until the startup manager has arrived at the jobsite.
- B. The startup manager shall be on Site full time at least 30 days prior to any field startup and testing activities and shall remain on site until all startup, testing, and commissioning activities are complete.

C. Startup Manager.

- 1. The startup manager shall be a startup and testing expert with a minimum of 5 years of experience starting up equipment and systems of similar type, size, capacity, and complexity to the equipment and systems included in this Project. The startup manager shall have the necessary experience to fully understand all startup requirements, to manage the Contractor's resources providing the startup services, and to prepare all startup documentation, as specified. The startup manager may be self-performed by the Contractor, provided they meet the requirements of this section. The startup manager's assigned duties and responsibilities are those specifically related to planning, supervising, and executing startup activities and shall include, but shall not be limited to the following:
 - a. Coordinating all testing and startup activities.
 - b. Preparing all startup and field testing plans, documentation, and forms.
 - c. Liaising between the Contractor, Engineer, and Owner for all startup and testing activities.
 - d. Developing a comprehensive schedule for all startup activities and providing regular schedule updates. The startup and testing schedule shall be incorporated into the Progress Schedule.
 - e. Scheduling and leading startup, testing, and commissioning planning meetings.
 - f. Conducting coordination meetings during startup, testing, and commissioning at least weekly.
 - g. Coordinating manufacturers' services and their certification of proper installation and/or operation of equipment as required by the Specifications.

Commissioning

- h. Overseeing and administering all startup, testing, and commissioning activities, including either direct participation in the activities and/or oversight and monitoring of activities. It shall be the startup manager's responsibility to assure that all tests have been completed in accordance with accepted testing procedures.
- i. Ensuring readiness for and coordinating maintenance, repair, and adjustment of equipment and systems during startup testing, and commissioning.
- j. Conducting or overseeing pre-test checks to ensure readiness for testing.
- k. Verify all piping hydrostatic testing and flushing has been completed prior to field testing connected equipment.
- l. Ensuring all testing equipment is in proper working order and has been calibrated to appropriate standards.
- m. Developing safe work policies and procedures including lockout/tagout procedures and personal protective equipment policies, that will be followed during all field startup and testing activities. At a minimum the Contractor shall comply with OSHA and the Owner's established safety guidelines. It shall be the startup manager's responsibility to assure all safety procedures are followed at all times.
- n. Reviewing and approving all equipment training sessions prior to submission to Engineer, to assure that the training is compliant with the requirements of the Specifications and includes all applicable operation, maintenance, safety, functional, performance, and startup and testing information.
- o. Organizing teams made up of qualified representatives of Suppliers, Subcontractors, and others, as appropriate, to efficiently and expeditiously startup and test the equipment and systems installed and constructed under this Contract. The objective of this program shall be to demonstrate to the Engineer and Owner that the structures, systems, and equipment constructed and installed under this Contract meet all performance requirements and the facility is ready for operation as intended. In addition, the testing program shall produce baseline operating conditions for the Owner to use in a preventive maintenance program.
- p. Ensuring the development and maintenance of records documenting all startup, testing, and commissioning activity. The records shall be organized by major process system into organized files/binders and turned over to the Owner prior to applying for final payment. Testing records shall be accessible to the Engineer and Owner at all times to allow monitoring of the progress.
- q. Ensuring the startup team is equipped and ready to make emergency repairs and adjustments to equipment installed and modified as part of the Project.
- r. Scheduling and conducting a one day workshop with the Owner and Engineer to resolve submittal review comments to the Contractor's startup, testing, and commissioning plan submittal.
- s. Notifying the Owner and all respective equipment manufacturers at least 21 days prior to the date when each equipment system is scheduled for pre-startup activities and checks.

Commissioning

- t. Organize International Electrical Testing Association (NETA) acceptance testing in accordance with the Electrical Equipment Installation section.

D. Startup Team.

1. The startup team shall include the startup manager and all staff deemed necessary for successful completion of startup, testing, and commissioning. This will typically include engineers, major equipment vendors, operators, and representatives from the Instrumentation and Control System Supplier. Additional trade representatives may be included as project requirements dictate.

E. Manufacturer's Field Services Representative.

1. The manufacturers shall provide a technically qualified field-service representative for the installation, startup, and testing of equipment furnished, as specified in the equipment sections and the Procurement Documents.
2. The manufacturer shall submit qualifications and experience records for all key personnel to be involved in startup activities.
3. The manufacturer's field services representative shall be employed full-time in installation, startup, and testing of similar equipment and facilities and work directly for the manufacturer.
4. The representative shall have conducted startup activities similar to those required herein on at least two other projects of similar complexity.
5. The Owner or Engineer shall have the right to reject the manufacturer's field services representative at any time, for immediate replacement by the manufacturer, if the accepted qualifications are not representative of the actual experience or abilities of the representative, as determined by the Owner or Engineer.

1.5 SUBMITTALS.

A. Startup Manager Qualifications

1. Startup manager's qualifications and past project experience including contact names, addresses and current telephone numbers of owner representatives that can be used to verify the accuracy of the information. Submittal shall be made at the preconstruction conference.

B. Manufacturer Representative Qualifications

1. Manufacturers' field services representative's qualifications and past project experience including contact names, addresses and current telephone numbers that

Commissioning

can be used to verify the accuracy of the information. Qualification submittals shall be made 3 weeks before the manufacturer's representative is scheduled to be on Site.

C. Installation Certifications

1. Manufacturer's certification of proper installation of all equipment as specified in the equipment sections.

D. Plans and Schedules

1. Equipment and system startup, testing, and commissioning plans and schedule in accordance with the requirements of this section. Startup manager shall coordinate with Subcontractors and include their information in the startup and testing plan.

E. Field Calibration Results

1. Unless otherwise specified in the equipment sections, preliminary copies of field calibration results. Submittal shall be made prior to the start of each test for associated systems.

F. Daily logs.

G. General

1. Submittals shall be provided in accordance with the requirements of the Submittals Procedures section.

1.6 STARTUP AND TESTING REQUIREMENTS.

A. Startup Checks.

1. Prior to field testing of all equipment, the Contractor shall perform the following:
 - a. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.
 - b. Lubricate equipment in accordance with manufacturer's instructions.
 - c. Turn rotating equipment by hand.
 - d. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
 - e. Test and commission related electrical system components in accordance with the requirements specified in the Electrical and the Electrical Equipment Installation sections.
 - f. Calibrate all instruments associated with the equipment.
 - g. Check for proper rotation, adjustment, alignment, balancing, mechanical and electrical connections, and any other conditions that may damage or impair equipment from functioning properly.
 - h. Inspect and verify proper anchorage.

Commissioning

- i. Obtain manufacturer's certification of proper installation where specified in the equipment sections.
2. All equipment shall be confirmed ready to test by the Engineer based on the following:
 - a. Acceptance of Contractor's startup and testing plan.
 - b. Notification in writing by the startup manager that each piece of equipment or system is ready for testing.
 - c. Verification by the Engineer and Owner that all lubricants, tools, maintenance equipment, spare parts and approved equipment operation and maintenance manuals have been furnished as specified.
 - d. Cleanliness of equipment, devices, and connected work.
 - e. Adequate completion of work adjacent to or interfacing with equipment to be tested.
 - f. Confirmation of manufacturer's representative's availability to assist with testing, where specified, and satisfactory fulfillment of all other manufacturers' responsibilities as specified.
 - g. Engineer's inspection of all related civil construction, mechanical, and electrical installations.
 - h. Confirmation of completion of acceptable testing of all adjacent piping, duct work and other affected Work.

B. Functional Testing.

1. All startup checks shall be completed prior to functional testing. Functional testing shall be in accordance with relevant standards and in accordance with instructions of the manufacturers.
2. Ancillary and/or temporary facilities necessary to recycle, control, or discharge water, air, chemical, or gas from facilities being tested, shall be operational.
3. Functional testing shall include the functional operation of each piece of equipment. All moving parts of equipment and machinery shall be tested and adjusted so that they move freely and function satisfactorily. Functional testing shall demonstrate correct operation of all hardwired interlocks and controls.
4. Functional testing of power actuated valves shall include at least 4 full open-close operations. Testing shall demonstrate the maximum number of operations per hour as recommended by the actuator manufacturer without overheating.
5. Once functional testing of individual pieces of equipment is completed, individual systems functional testing shall commence. Individual system functional testing shall include startup of the complete system of mechanical, electrical, and instrumentation and control equipment as a functional process system. Field inspection prior to startup as specified in the Instrumentation and Control System section, other testing by the Instrumentation and Control System Supplier required

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to verify readiness for automatic operation of the individual system, shall be completed before commencement of individual system functional testing.

6. Individual system functional testing shall include operation in manual and automatic modes, startup operation, and shutdown in normal and emergency modes. Individual systems shall be tested over their entire operating range and for sufficient time to demonstrate the intended functionality of each piece of equipment and the system. If any part of a system shows evidence of unsatisfactory or improper operation during the test period, correction or repairs shall be made and the functional testing shall be repeated until satisfactory results are obtained.
7. Functional testing of all process and pumping equipment and drive motors, including auxiliary equipment, shall be in accordance with the appropriate and approved test codes, such as those specified by the American Society of Mechanical Engineers, Hydraulic Institute Standards, and IEEE.
8. Qualified personnel from the electrical and mechanical trades responsible for installation of the equipment, shall be available during functional testing involving electrically operated equipment. Where appropriate, a representative of the Instrumentation and Control System Supplier shall also be available.

C. Functional Acceptance Testing.

1. Once the Contractor's functional testing is complete and associated documentation has been submitted and accepted by the Engineer, the Contractor shall conduct functional acceptance testing of each complete process system, to demonstrate individual systems meet the specified requirements. Acceptance testing shall include the successful demonstration of all operating functions and conditions that are specified for the equipment, system, and controls. The manufacturer's representative shall be on Site during acceptance testing when specified in the equipment specifications.
2. The Functional Acceptance Testing shall include the following submissions prior to commencement:
 - a. Prerequisite checklist, to be acknowledged by the Engineer prior to initiating the test, that demonstrates that all testing and other Work required to be completed prior to the test is complete.
 - b. Listing of Owner's personnel necessary to operate the system and conduct any related monitoring of performance.
 - c. A listing of Contractor's personnel designated to supervise and direct the Owner's operators as required herein.
 - d. Listing of standby personnel, equipment, and materials that will be available if needed during the test period.
 - e. Step-by-step procedures for operation of the facility showing how local and remote control of equipment will be demonstrated.

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- f. Description of all data and other information to be reported in support of the completed test. Include any blank data logs that may be used for recording results.
 - g. Descriptions of all necessary calculations that must be completed to verify the specified results are being achieved, including formulas.
 - h. Blank sign-off form for the test acknowledging the Contractor's, Engineer's, Owner's, and the equipment manufacturer's acceptance of the test.
3. Contractor shall provide Owner and Engineer 14 days notice prior to testing of any individual system.
 4. Individual system acceptance testing shall continue for 48 hours without interruption for each system, and all parts shall operate satisfactorily in all respects under a range of conditions to simulate the full operating range of the equipment or system. If there are multiple parallel components or trains, then the testing duration will be 48 hours for each individual train.
 5. If any part of a system shows evidence of unsatisfactory or improper operation during the testing period, correction or repairs shall be made and the test repeated until the test is successfully completed. Testing interrupted by power failure will not be required to be repeated, but the test shall be continued upon restoration of power and extended to the specified duration at no additional cost to the Owner.
 6. During this testing period the Contractor shall operate all equipment.

1.7 COMMISSIONING.

- A. Once startup and testing is complete; documentation of all startup and testing activities in the form of a report shall be submitted for reviewed and accepted by the Engineer. The report shall include a table of contents and be clearly organized.
- B. After acceptance, commissioning of the constructed facilities shall be conducted by the Contractor working with the Owner and Engineer.
- C. The facility shall be operated in accordance with the operating permit, laws, and regulations.
- D. The Contractor shall provide mechanics, electricians, and controls technicians during commissioning as required for troubleshooting and repair.

1.8 OPERATION ACCEPTANCE TESTING.

- A. At the completion of the Individual System Acceptance Tests and when the overall process has stabilized sufficiently as determined by the Engineer, operational acceptance testing of the complete facility constructed or modified under the Contract

Commissioning

shall be conducted. Operational acceptance testing shall not be conducted concurrently with other individual system acceptance or performance tests.

- B. The test shall run at least 10 days with the entire facility operating in the intended manner. The test shall demonstrate to the satisfaction of the Engineer that the facilities are complete and meet all specified requirements and can be continuously operated for their full intended function. During the testing period, the plant shall operate under all control modes, including manual, remote-manual, and automatic. The Owner's staff shall operate the facility.
- C. Duty and standby equipment shall be alternated so that all equipment is selected for duty operation for a period of at least 2 days during the test. Unless indicated otherwise, if any item malfunctions or a defect is found during the test, the item shall be repaired and the test either extended a duration to be determined by the Engineer and Owner depending on the severity of the malfunction or defect, or restarted at time zero with no credit given for the operating time before the malfunction or the defect was found. Malfunctions or defects meeting both of the following conditions may, at the Engineer's discretion, be considered grounds for not requiring restarting the test at time zero:
 - 1. Malfunctions that do not cause an interruption to the operation of the facility because standby equipment can be placed into service.
 - 2. Malfunctions that are corrected within four (4) hours of the time the malfunction is detected. Correction of a malfunction or defect will be considered complete only after the affected equipment is placed back into service and is operating as intended for a continuous period of 24 hours without additional failure.
- D. All malfunctions, defects in materials or workmanship, or other flaws, which appear during this test period, shall be immediately corrected by the Contractor. If spare parts from the specified spare parts inventory are used to make repairs, they shall be replaced immediately and must be replaced prior to application for final payment.
- E. The Contractor shall supply all oil, grease, lubricants, and ancillary equipment required for operational acceptance testing.
- F. All plant control system coordination issues shall be resolved and data trending requirements shall be functional during this period.
- G. During operational acceptance testing, plant effluent meeting permit requirements as determined by the Owner, will be discharged to the outfall.

Commissioning

1.9 PERFORMANCE TESTING.

- A. Performance testing shall be conducted in accordance with requirements specified in the specification sections and contract documents listed below.

1. 46 66 56 Open Channel UV Disinfection System

- B. The Owner will provide chemicals, water, and power required during performance testing of the new facilities. Contractor shall notify the Engineer 45 days prior to any testing activities to allow the Owner time to order process chemicals and have them delivered to the site for testing. Contractor shall furnish all additional chemicals necessary to complete the test.

1.10 STARTUP SCHEDULE AND STARTUP AND COMMISSIONING PLANS.

- A. Plans and schedules shall be developed to facilitate coordinated and efficient startup, testing, and commissioning of the Project equipment and systems.
- B. The Contractor shall submit a startup, testing, and commissioning plan and schedule to the Engineer no later than 90 calendar days prior to the commencement of startup and testing. A minimum of 21 days shall be allowed for review by Engineer and Owner. The schedule and plan must be accepted a minimum of 30 days prior to commencement of startup and testing. The schedule and plan shall include sections for startup checks, functional testing, functional acceptance testing, commissioning, operational acceptance testing, and performance testing.
- C. Forms for startup and testing shall include identification of equipment or system, startup/test date, nature of startup/test, startup/test objectives, startup/test prerequisites, startup/test results, instruments employed for the startup/test and signature spaces for the Engineer's witness (where applicable) and the Contractor's startup manager.
- D. Startup Schedule.
1. A startup schedule that provides an overall sequence and duration for all startup, testing and commissioning activities, shall be prepared and maintained.
2. This schedule shall serve as a companion to but shall not be a replacement for the startup plan. The startup schedule described in this section shall be integrated into the overall Progress Schedule and shall be prepared as specified for the Progress Schedule in the Construction Progress Schedule section.
3. The Startup Schedule shall be updated weekly to during the startup, testing, and commissioning period.
- E. Startup Plan.
1. The Startup Plan shall include the following:

Commissioning

- a. Introduction with a narrative description of the overall testing and startup program. The description shall include all contractual or regulatory treatment requirements to be demonstrated.
 - b. A summary of the objectives and approach for startup checks, functional testing, functional acceptance testing, commissioning, operational acceptance testing, and Performance Testing.
 - c. List of the instruments, equipment, and systems that will undergo startup and testing with references to the appropriate PIDs, equipment tags/identification numbers, Specification number and standards for testing procedures.
 - d. Schedule for startup and field testing for each instrument, piece of equipment (including redundant equipment), and system.
 - e. Safety and emergency response plan including a list of emergency and non-emergency contacts (email and phone).
 - f. Organization chart for Contractor's startup and testing personnel with assigned responsibilities for each.
 - g. Startup and testing record keeping plan.
 - h. Plan for reuse and disposal of water/wastewater from startup, testing, commissioning including information on any required regulatory permits/approvals.
 - i. Description of temporary facilities that will be provided.
 - j. List of chemicals to be provided by the Owner.
2. Within 7 to 14 days of initial submittal of the startup plan, the Contractor shall schedule a workshop with the Owner and Engineer to present the plan. The Contractor shall submit minutes of the workshop, including action items and a schedule for updating the startup plan, to the Engineer within 3 days of the workshop.
 3. Individual plans for each phase of startup, testing, and commissioning can be assembled as chapters in the startup plan or submitted as individual documents but should be correlated to ensure there is not disagreement between chapters or separate documents.

F. Startup Checks Plan.

1. The startup checks plan shall be subdivided into plans for each system and major component. Each system/major component plan shall include but not be limited to the following:
 - a. Identification of information for each component or piece of equipment to be inspected as part of the system. All applicable tag numbers shall be included.
 - b. Specific activities to be completed on each component, piece of equipment, or system as required to demonstrate proper installation and connection.
 - c. A tracking checklist of prerequisites for the checks and each step of the checking procedure, including any temporary facilities or utility requirements.

Commissioning

- d. Listing of manufacturer's representative(s) to be on site during the check.
- e. Sign off forms for the Contractor's startup manager.

G. Functional Testing and Functional Acceptance Testing Plans.

- 1. The functional testing plan shall include procedures and reporting for functional testing. The functional testing plan shall be subdivided into testing plans for each system. Each system test plan shall include but not be limited to the following:
 - a. A narrative description of the purpose and goals of the test for each component, piece of equipment, or system, which should include all activities (including those required by vendors/suppliers) necessary to verify proper equipment and system functionality.
 - b. Identification of each component or piece of equipment to be tested as part of the system. All applicable tag numbers shall be included.
 - c. Schedule and duration for the tests.
 - d. Prerequisites for each test, including any temporary facilities or utility requirements.
 - e. Pass/fail criteria for the test.
 - f. A checklist for tracking testing progress which includes prerequisites for the test and each step of the testing procedure. The check list shall include specified performance criteria that are to be met.
 - g. A description of test apparatus required to conduct the test.
 - h. Identification of all temporary facilities and chemicals require during startup.
 - i. Listing of manufacturer's representative(s) to be on site during the test.
 - j. Certificates of proper installation, as applicable to the test.
 - k. Step-by-step detailed procedure of the test. The level of detail shall be sufficient for a witness to be able to follow the steps during the test and be confident that the test is being performed as planned. All steps required to proceed through the test in an orderly manner are considered significant and each of these steps shall be included in the procedure.
 - l. Copies of the data recording forms that will be used during the test.
 - m. Calculation methodologies to be used to evaluate the data and/or test criteria for the test.
 - n. Sample computations or analyses for the test with results in the same format as the final report. This item is intended to demonstrate how data collected will be used to generate final results. A sample shall be included for each type of computation required for the test and analysis of results.
 - o. Blank sign-off forms for the test acknowledging the startup manager's, Engineer's, Owner's, and equipment manufacturer's acceptance of the test where applicable.

1.11 REPORTS AND RECORDS.

- A. Records of all startup and testing shall be compiled by the Contractor and submitted to the Engineer.

Commissioning

- B. Prior to being submitted to the Engineer, the startup manager shall certify that the results recorded and the tested systems comply with the Contract requirements.
- C. Records shall include all documentation assembled for each piece of equipment or system involved in the startup and testing, including all certifications, forms, and check lists completed during the startup and test, and sign-off forms.
- D. Records of all startup and testing shall be compiled as separate documents for each system tested, and shall be submitted within 48 hours of completion of the startup and testing for each system.
- E. Testing samples that require analysis periods greater than 48 hours shall be clearly defined in the startup plan but shall not preclude delivery of the balance of the records within the 48 hour timeframe.
- F. The Contractor shall provide formal reporting and documentation of failures, malfunctions or defects, and repairs made during the startup and/or testing activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Demolition

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the demolition of existing structures, and equipment, and as indicated on the Drawings.

1.2 GENERAL

- A. Contractor shall be responsible for all work under this section. Contractor shall provide 14 days written notice prior to beginning demolition activities.
- B. All structures and facilities of the existing City of Ann Arbor Water Resource Recovery Facility which are not to be removed must remain in continuous operation during the work.
- C. Demolition work shall create minimum interference with Owner's operations and minimum inconvenience to Owner. Contractor shall provide protection and safety of all roadways, sidewalks, and all accessible areas during demolition activities.
- D. Blasting will not be permitted.

1.3 SUBMITTALS

- A. Demolition Plan.
 - 1. Contractor shall submit a detailed demolition plan indicating the major demolition activities, planned dates, Owner coordination requirements, permit requirements (if any), and any special planning considerations that require coordination with third-parties.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Removal of equipment or facilities shall include removal of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed. Existing materials and equipment removed, and not indicated to be reused as a part of the Work, shall become Contractor's property unless otherwise specified, and shall be removed from the Site and properly disposed of or recycled in accordance with state laws.

Demolition

- B. Contractor shall conduct demolition activities in a manner that prevents damage to existing facilities which are indicated to remain and shall provide all necessary protection for existing facilities. Any remaining facilities damaged during demolition shall be repaired by Contractor to a condition equal to or better than the original condition.
- C. When demolition is complete, all debris shall be removed from the Site.
- D. Structure Demolition
 - 1. The following structures at the City of Ann Arbor Water Resource Recovery Facility shall be demolished, and the debris shall be removed from the jobsite.
 - a. Portions of the UV Disinfection area as indicated on the Drawings.

3.2 SALVAGE.

A. Items To Be Salvaged by Contractor

- 1. Removed and salvaged equipment or facilities shall include removal and salvage of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed.
- 2. Existing materials and equipment removed, and not reused as a part of the work, shall become Contractor's property unless otherwise specified, and shall be removed from the jobsite.
- 3. The following items shall remain Owner's property and shall be delivered to Owner by Contractor in good condition at the delivery points indicated:

| <u>Item</u> | <u>Location</u> | <u>Delivery Point</u> |
|----------------------|----------------------|--------------------------------|
| UV Transformer 1A | UV Disinfection Area | TBD at Preconstruction Meeting |
| UV Transformer 1B | UV Disinfection Area | TBD at Preconstruction Meeting |
| ATS-UV | UV Disinfection Area | TBD at Preconstruction Meeting |
| PP-UV | UV Disinfection Area | TBD at Preconstruction Meeting |
| Slide Gate Actuators | UV Disinfection Area | TBD at Preconstruction Meeting |
| UV Channel Hatches | UV Disinfection Area | TBD at Preconstruction Meeting |

- 4. The following existing materials and equipment shall be removed by Contractor, shall be reused as a part of the work, and shall remain the property of Owner:

| <u>Item</u> | <u>Location</u> | <u>Location of Reuse</u> |
|-------------------|--------------------------|---|
| UV Transformer 2A | Tertiary Filter Building | Tertiary Filter Building (Channel 2) |
| UV Transformer 2B | Tertiary Filter Building | UV Disinfection Area, outside (Channel 1) |

Demolition

5. Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified herein or indicated to be salvaged and to remain the property of Owner. Contractor shall store and protect salvaged items specified or indicated to be reused in the work. Any items damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.
6. Contractor may, at their option, furnish and install new items instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor's property.

End of Section

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Section 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these Specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Waterstops.
 - 4. Form accessories.
 - 5. Form stripping.

1.3 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 – Specifications for Structural Concrete.
 - 3. ACI 318 – Building Code Requirements for Structural Concrete.
 - 4. ACI 347 – Guide to Formwork for Concrete.
- B. ASTM International:
 - 1. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - 2. ASTM E96/E96M – Standard Test Methods for Water Vapor Transmission of Materials.

Concrete Forming and Accessories

1.4 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.5 PERFORMANCE REQUIREMENTS

- A. Vapor Retarder Permeance: Maximum .01 perm or lower.

1.6 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
 - 1. Submit formwork and shoring shop drawings.
 - 2. Indicate the following:
 - a. Proposed construction joint locations.
 - b. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
 - c. Means of leakage prevention for concrete exposed to view in finished construction.
 - d. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
 - e. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
 - f. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.
 - g. Procedure and schedule for removal of shores and installation and removal of reshores.
- C. Design Data:
 - 1. Provide necessary design data and/or drawings for utility penetrations/crossings into building footprint.
 - 2. Indicate loads transferred to any existing structure during process of concreting, shoring and reshoring.
 - 3. Include structural calculations to support design.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301, ACI 318, and ACI 350.

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1.8 COORDINATION

- A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 – PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Form Materials: At discretion of Contractor.
- B. Lumber Forms:
 - 1. Application: Use for edge forms and unexposed finish concrete.
 - 2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- C. Plywood Forms:
 - 1. Application: Use for exposed finish concrete.
 - 2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
 - 3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
 - 4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- C. Pan Type: Steel of size and profile required.
- D. Tubular Column Type: Round, spirally wound laminated fiber, wood, glass fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.

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- E. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set.
- F. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.
- G. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.
- H. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

- A. Form Ties: Construct form ties so that the ends or end fasteners can be removed without causing spalling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, terminate the embedded portion of the ties not less than 2 diameters or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view except that in no case shall this distance be less than 3/4 inch. When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.
- B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers:
 - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
 - 2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
 - 3. Penetration of structural steel members is not permitted.
- D. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- E. Corners: Chamfer type; minimum 3/4 x 3/4 inch size; maximum possible lengths.
- F. Vapor Retarder: Where indicated on Drawings, Class A 15 mil thick polyethylene sheet.
- G. Bituminous Joint Filler: ASTM D1751.
- H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.
- I. Flexible PVC Waterstops: CE CRD-C 572; for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional

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changes. Select profile from options in first subparagraph below. Insert others if required.

1. Manufacturers:
 - a. BoMetals, Inc.
 - b. Greenstreak.
 - c. Meadows, W. R., Inc.
 - d. Murphy, Paul Plastics Co.
 - e. Progress Unlimited, Inc.
 - f. Tamms Industries, Inc.
 2. Vinylex Corp. Select profile from options in first subparagraph below. Insert others if required.
 3. Profile: Contractor's standard.
 4. Dimensions: 4 inches by 3/16 inch thick non-tapered.
- J. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Products:
 - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - b. Concrete Sealants Inc.; ConSeal CS-231.
 - c. Greenstreak; Swellstop.
 - d. Henry Company, Sealants Division; Hydro-Flex.
 - e. JP Specialties, Inc.; Earth Shield Type 20.
 - f. Progress Unlimited, Inc.; Superstop.
 - g. TC MiraDRI; MiraSTOP.

2.4 COATINGS

- A. Coatings for Aluminum in contact with concrete: Polyamide epoxy finish coat or coal-tar epoxy with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish, minimum 10 mils total dry film thickness.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Section 01 10 00 Summary: Coordination and project conditions.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

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- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 INSTALLATION

A. Earth Forms:

- 1. Earth forms are not permitted.

B. Formwork – General:

- 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
- 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
- 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
- 4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
- 5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:

- 1. Use steel, plywood or lined board forms.
- 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
- 3. Install form lining with close-fitting square joints between separate sheets without springing into place.
- 4. Use full size sheets of form lines and plywood wherever possible.
- 5. Tape joints to prevent protrusions in concrete.
- 6. Use care in forming and stripping wood forms to protect corners and edges.
- 7. Level and continue horizontal joints.
- 8. Keep wood forms wet until stripped.

- D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

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- E. Framing, Studding, and Bracing:
 - 1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
 - 2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 3. Construct beam soffits of material minimum of 2 inches thick.
 - 4. Distribute bracing loads over base area on which bracing is erected.
 - 5. When placed on ground, protect against undermining, settlement or accidental impact.
- F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.
- G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- H. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.
- I. Install chamfer strips on external corners of beams, joists, columns, and walls.
- J. Install void forms in accordance with manufacturer's recommendations.

3.3 APPLICATION – FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish." Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION – INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.

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- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Water Stops:
 - 1. Waterstops shall be fully continuous for the extent of the joint. Splices shall be accomplished in accordance with the manufacturer's instructions.
 - 2. Prefabricate multiple joint splices, joints with an angle cut, alignment change, or the joining of dissimilar sections prior to placement.
 - 3. Adequately support waterstops during installation and concrete pours. Holes in the waterstop material are prohibited.
 - 4. Limit waterstop exposure to direct sunlight to two days.
 - 5. Repair or replace damaged waterstops prior to concrete pours. Seal concrete joints if leaks occur.
 - 6. Use expandable waterstop materials at joints between new concrete and existing concrete structures.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- H. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Place ties at least 1 inch away from finished surface of concrete.
 - 3. Leave inner rods in concrete when forms are stripped.
 - 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- J. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.

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3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:

1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Scream Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad, or base type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

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O. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

- A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.
- B. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 318.

3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00 Quality Requirements: Field inspecting, testing, adjusting, and balancing.

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- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Schedule concrete placement to permit formwork inspection before placing concrete.

End of Section

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Cast-in-Place Concrete

Section 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these Specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 DESCRIPTION

- A. This Section includes furnishing and installing cast-in-place concrete.

1.3 SUBMITTALS

- A. Proposed mix design for each concrete strength prepared by an approved independent testing firm for each class of concrete. Select proportions according to ACI 301, Section 3.8, Method 1 or Method 2. Show admixtures if applicable. Obtain Engineer's approval of mix prior to placement of concrete.
- B. Shop drawings showing fabrication dimensions and locations for placing the reinforcing steel and accessories. Details of reinforcement and accessories shall be in accordance with ACI 315.
- C. Certifications for the following:
 - 1. Cement
 - 2. Aggregates
 - 3. Admixtures
 - 4. Reinforcement: Mill test report
- D. Quality Control Plan, Procurement, Construction and Testing.

1.4 REFERENCES

- A. ACI 301, Specifications for Structural Concrete
- B. ACI 305R, Guide to Hot Weather Concreting
- C. ACI 306.1, Standard Specification for Cold Weather Concreting

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- D. ACI 308.1, Specification for Curing Concrete
- E. ACI 318, Building Code Requirements for Structural Concrete
- F. ACI 350, Code Requirements for Environmental Engineering Concrete Structures

1.5 COORDINATION

- A. Section 01 10 00 Summary: Coordination and Project Conditions
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI Standards.
- B. Comply with ACI 305R when pouring concrete during hot weather.
- C. Comply with ACI 306.1 when pouring concrete during cold weather.
- D. Acquire cement and aggregate from one source for Work.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I.
 - a. Fly Ash: ASTM C 618, Class C or F. Maximum of 20 percent by weight.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 - 2. For Elements of Thickness 36 inches or greater, Portland Cement: ASTM C150, Type II:
 - a. Fly Ash: ASTM C618, Class C or F. Minimum of 25 percent by weight.
 - b. Ground granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 - c. Maximum allowable temperature of concrete during curing shall not exceed 135° F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: as indicated/as required.

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2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Mixing water: ASTM C94, Clean, fresh, and potable, without deleterious amounts of chloride ions.
- D. Admixtures:
1. Air-entraining: ASTM C260
 2. Water-reducing, retarding, and acceleration: ASTM C494 Types A, B, and C. Calcium chloride will not be permitted as an admixture.
 3. Pozzolanic admixtures: ASTM C618, Type F, loss on ignition limited to 4 percent.
- E. Synthetic Fiber Reinforcement: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Monofilament Fibers:
 - a. Axim Concrete Technologies; Fibrasol IIP.
 - b. Euclid Chemical Company (The); Fiberstrand 100.
 - c. FORTA Corporation; Forta Mono.
 - d. Grace Construction Products, W.R. Grace & Co.,; Grace MicroFiber.
 - e. Metalcrete Industries; Polystrand 1000.
 - f. SI Concrete Systems; Fibermix Stealth.
- F. Steel Reinforcement:
1. Bars: Deformed, ASTM A615 (S1), Grade 60.
 2. Welded wire fabric: Plain, ASTM A185. Fabricated from as-drawn steel wire into flat sheets.
- G. Reinforcement Epoxy Coating (if noted): ASTM A775, fusion bonded, shop applied:
1. Scotchkote 413, The 3M Company.
 2. Flintflex 531-6086, E.I. DuPont DeNemours Company, Inc.
 3. NAP-GARD 7-2709 Rebar, O'Brien Powder Products, Inc.
- H. Welded Plain Wire Fabric: ASTM A185 in flat sheets or coiled rolls.
- I. Accessories:
1. Tie wire: 16 gauge annealed.
 2. Chairs, bar supports, bolsters, spacers: CRSI, Class C for structural slabs, Class A, for slabs-on-grade. Include load-bearing pad to prevent vapor retarder puncture.

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3. Form ties: Commercially manufactured, water seal form ties with minimum 1-inch diameter steel or neoprene collar at midpoint for walls subject to hydrostatic pressure.
 4. Joint Dowel Bars: ASTM A615/A 615M, Grade 60, plain-steel bars cut bars true to length with ends square and free of burrs.
- J. Premolded Joint Filler:
1. Exterior: ASTM D1751, non-extruding, bituminous.
 2. Interior: ASTM D1752, non-extruding, non-bituminous.
- K. Latex Bonding Agent: W.R. Meadows “Intralok,” L&M Construction Chemicals “Everbond,” Sonneborn “Sonocrete,” or equal.
- L. Epoxy Bonding Agent: L&M Construction Chemicals “Permunitite,” Sonneborn “Sonobond,” Toch “Epotox 350,” or equal.
- M. Plastic Vapor Barrier: ASTM E1745, Class A, minimum 15 mils, and with a permeability rate of 0.01 perms or lower.
1. Products:
 - a. Premoulded Membrane with Plasmatic Core by W.R. Meadows.
 - b. Zero Perm by Alumiseal.
 - c. Stego Industries, LLC; Stego Wrap 15-mil Vapor Barrier.
 - d. Or equal.
 2. Accessories:
 - a. Seam Tape: ASTM E96 with a perm rate of 0.01 perms or lower.
 - b. Vapor Proofing Mastic: ASTM E96 with a perm rate of 001 perms or lower.
 - c. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer’s instructions.
- N. “Dry Shake” for Nonslip finish: Aluminum oxide type: L&M Construction Chemicals “Grip It,” Toch “Toxgrip,” Sonneborn “Frictex,” or equal.
- O. Curing Compound: ASTM C309.
- P. Floor Sealer/Curing Compound: ASTM C309, Federal Specification TTC-00542-B: Tnemec CT Densifyer, Series 629 or ChemMaster Duraguard 300.
- Q. Joint Sealant: Semi-rigid, non-tracking type: W.R. Meadows “Sealtight Gardor” or equal.
- R. Wall Finish: Thoro “Thoroseal” applied according to manufacturer’s instructions may be substituted for a grout cleaned finish specified in Section 3.1L.4.

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S. Non-shrink Grout:

1. Reference Section 03 60 00 Grouting.
2. Manufacturers:
 - a. Furnish materials according to specified standards.
3. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
4. Comply with ASTM C1107 (C1107M).

2.2 PROPORTIONING CONCRETE

- A. Proportions and materials: See Schedule A.
- B. Admixtures: Approval of Engineer required. Use in accordance with the manufacturer's instructions.
- C. If the Contractor intends to place concrete by pumping, the mix design shall be prepared in accordance with these specifications and the recommendations of ACI 304.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate in accordance with approved shop drawings and ACI 315.
- B. Reinforcing splices: Class C unless otherwise shown.

PART 3 – EXECUTION

3.1 PLACEMENT

- A. Existing Concrete Preparation and Cleaning
 1. Remove existing built-up water proofing membrane on all surfaces.
 2. Clean off all residue as required leaving existing concrete clean and ready to receive new concrete layer or new finish material as called out on drawings and in finished schedule.
 3. Contractor to be responsible for method of concrete cleaning and to secure all permits if using hazardous cleaning as it relates to run off towards the creek and soil contamination.
 4. Contact engineer for inspection of existing surfaces prior to placement of new concrete or finished material.

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5. See Section 3.1E.4 for bonding methods in areas that receive new concrete.
 6. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- B. Plastic Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 2. Seal all penetrations (including pipes) per manufacturer's instructions.
 3. Lap Vapor Barrier over footings and turn-up along foundation walls.
- C. Formwork:
1. Formwork design is the responsibility of the Contractor.
 2. Earth cut forms are prohibited.
 3. Place chamfer strips in the corners of forms to produce beveled edges on permanently exposed surfaces. Interior corners on such exposed surfaces and the edges of formed joints will not require beveling.
 4. Provide temporary openings at the base of forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
 5. Construct form ties so that the ends or end fasteners can be removed without causing spalling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, terminate the embedded portion of the ties not less than 2 diameters or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view except that in no case shall this distance be less than 3/4 inch. When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.
 6. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1 inch. Prevent offsets or loss of mortar at the construction joint and maintain a true surface.
 7. Formwork tolerances: See Schedule B.
 8. Clean form surfaces and embedded materials of accumulated mortar or grout from previous concreting and of other foreign material before placing concrete.
 9. Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices and embedded items.

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10. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.
 11. Do not allow excess release agent material to stand in puddles in the forms. Do not allow release agent to come in contact with hardened concrete against which fresh concrete is to be placed.
 12. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.
 13. Inform Engineer when formwork is complete and has been cleaned, to allow for inspection. Obtain approval prior to placing concrete.
- D. Placement of Reinforcement: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Place reinforcement as indicated on approved shop drawings and to the following tolerances:
 - a. Clear distance to formed surfaces:
 - 1) 2 inch (#6–#18 bars)
 - 2) 1-1/2 inch (#5 & smaller bars)
 - b. Minimum spacing between bars: 3 inch
 - c. Top bars in slabs and beams:
 - 1) 2 inch (#6–#18 bars)
 - 2) 1-1/2 inch (#5 & smaller bars)
 - d. Depth tolerance plus/minus 3/8 inch; cover tolerance plus/minus 3/8 inch.
 2. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars must be approved.
 3. Minimum concrete protective covering for reinforcement:
 - a. Concrete deposited against the ground: 3 inches.
 - b. Formed surfaces exposed to weather or in contact with the ground or exposed to wastewater: 2 inches for reinforcing bars #6 or larger; 1-1/2 inches for reinforcing bars less than #6.
 - c. Interior surfaces not exposed to wastewater: 1-1/2 inches for beams, girders, and columns; 3/4 inch for slabs, walls and joists with #11 bars or smaller and 1-1/2 inches with #14 and #18 bars.
 4. Reinforcement, at the time concrete is placed, shall be free of loose rust, mill scale, ice, mud, oil or other materials that may adversely affect or reduce the bond.

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5. Do not cut or puncture vapor barrier. Repair damage and re-seal vapor barrier prior to placing concrete.
6. Unless permitted by the Engineer, do not bend reinforcement after it is in hardened concrete.
7. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
8. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
9. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
10. Where indicated on the drawings, weld reinforcing in accordance with applicable requirements of AWS D12.1. No welding is permitted without specific approval of the Engineer. No welding of crossing bars (tack welding) is permitted.
11. Bond and ground reinforcement in accordance with Division 26 requirements.

E. Construction Joints:

1. Place formed construction joints in floor slabs and walls as shown on drawings or at maximum 20-foot intervals (or per Engineer approved submittal). Secure to resist movement during concrete placement.
2. All reinforcement shall be continued across joints. Keys shall be provided. Longitudinal keys at least 1-1/2 inches deep shall be provided in all joints in walls and between walls and slabs or footings.
3. Thoroughly clean and remove all laitance from joints prior to placing adjoining concrete.
4. When joining new concrete to previously existing concrete, obtain bond by one of the following methods:
 - a. The use of an approved bonding agent. Use epoxy bonding agent in joints exposed to moisture or below grade. Use latex bonding agent in other applications.
 - b. Roughening the surface of the concrete in an approved manner, which will expose the aggregate and will not leave laitance, loosened particles of aggregate, or damaged concrete at the surface.

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F. Expansion/Isolation Joints:

1. Reinforcement or other embedded metal items bonded to the concrete not to extend continuously through any expansion joint. Exception is dowels in floors bonded on only one side of joints.
2. Use pre-molded expansion joint filler where shown.

G. Embedded Items:

1. Provide formed openings where pipes, conduits, sleeves, and other work will pass through concrete members.
2. Accurately locate and set in place items that are to be cast directly into concrete.
3. Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
4. Install all concrete accessories in accordance with Drawings and manufacturer's recommendations; straight, level, and plumb. Secure items to avoid displacement during concrete placement.
5. Fill voids in sleeves, inserts, and anchor slots temporarily with a removable material to prevent entry of concrete.
6. No aluminum items shall be embedded in concrete, unless specifically indicated on the Drawings.

H. Concrete Production:

1. General:

- a. All concrete shall be ready-mixed and shall be batched, mixed, and transported in accordance with "Specifications for Ready-Mixed Concrete," ASTM C94. Plant equipment and facilities shall conform to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.
- b. Mix concrete only in quantities for immediate use. Batch-to-discharge time shall not exceed 60 minutes. Concrete that has set shall not be retempered, but shall be discarded.
- c. When concrete arrives at the project with slump below that suitable for placing, as indicated by the specifications, water may be added only if neither the maximum permissible water/cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. An addition of water above that permitted by the limitation on water/cement ratio shall be accompanied by a quantity of cement sufficient to maintain the proper water/cement ratio. Such addition shall be accomplished only upon authorization of the Engineer.

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2. Cold weather: Cold weather concreting shall follow the recommendations of ACI 306R, except as otherwise approved by the Engineer.
 3. Hot weather: Hot weather concreting shall follow the recommendations of ACI 305R, except as otherwise approved by the Engineer.
- I. Placing Concrete – General:
1. Preparation:
 - a. Remove hardened concrete and foreign materials from the inner surfaces of the conveying equipment.
 - b. Formwork shall have been completed; snow, ice, and water shall have been removed; reinforcement shall have been secured in place; expansion joint material, anchors, and other embedded items shall have been positioned; and the entire preparation shall have been approved.
 - c. Do not place concrete on frozen ground.
 2. Conveying:
 - a. Convey concrete from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent segregation or loss of ingredients and will maintain the quality of the concrete.
 3. Depositing:
 - a. General: Deposit concrete continuously or in layers of such thickness, maximum 2 feet, such that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. No interruption shall exceed 45 minutes.
 - b. Segregation: Do not subject concrete to any procedure that will cause segregation. Maximum vertical drop is 4 feet.
 - c. Consolidation: Consolidate concrete by vibration, spading, rodding, or forking so that the concrete is thoroughly worked around the reinforcement around embedded items, and into corners of forms, eliminating all air or stone pockets that may cause honeycombing, pitting, or planes of weakness. Keep a spare vibrator on the job site during all concrete placing operations.
 4. Protection:
 - a. Unless adequate protection is provided and approved, do not place concrete during rain, sleet, or snow.
 - b. Do not allow rainwater to increase the mixing water nor to damage the surface finish.
 5. Bonding:
 - a. When joining new concrete to previously existing concrete, prepare the surface of joints in accordance with one of the methods specified in Section 3.1C.4.

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- b. Immediately prior to placing of fresh concrete, dampen, but do not saturate, the hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls, and all others not mentioned below.
- c. The hardened concrete of joints in exposed work; joints in the middle of beams, girders, joists, and slabs; and joints in work designed to contain liquids shall be dampened, but not saturated, and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 1/2-inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.
- d. Joints receiving a bonding agent shall have been prepared and agent applied in accordance with the manufacturer's recommendations prior to placing of fresh concrete.

J. Removal of Formwork:

1. Do not remove forms, shores, and bracing until concrete has gained sufficient strength to carry its own weight, and construction and design load that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
2. Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

K. Repair of Surface Defects:

1. Repair surface defects, including tie holes, immediately after form removal.

L. Finishing of Formed Surfaces:

1. For all unexposed concrete, provide a rough form finish.
2. For all exposed concrete, provide a smooth form finish.
3. Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces.
4. For all concrete that is to be coated or painted, provide a grout cleaned finish on a smooth form finish.
5. All exposed interior and exterior walls shall receive a "Thoroseal" finish applied according to manufacturer's instructions. Interior tank walls shall receive a smooth form finish, suitable for crystalline waterproofing.

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M. Placing and Finishing Concrete Slabs:

1. Preparation of subgrade for slabs on ground:
 - a. The subgrade shall be well drained and of uniform load bearing nature. The in-place density of the subgrade soils shall be at least the minimum required in the specifications. The bottom of an undrained granular base course shall not be lower than the adjacent finished grade.
 - b. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing, raise and maintain the temperature above 50°F long enough to remove all frost from the subgrade.
 - c. The subgrade shall be moist at the time of concreting. If necessary, dampen with water in advance of concreting but do not allow free water standing on the subgrade nor any muddy or soft spots when the concrete is placed.
2. Edge forms and screeds:
 - a. Set edge forms and intermediate screed strips accurately to produce the designated elevations and contours of the finished surface.
3. Placement:
 - a. Carefully coordinate mixing and placing with finishing. Do not place concrete on the subgrade or forms more rapidly than it can be spread, straight edged, and darried or bull floated. These operations must be performed before bleeding water has an opportunity to collect on the surface.
4. Jointing:
 - a. Locate and detail joints as indicated. If saw-cut joints are required or permitted, cutting shall be timed properly with the set of the concrete. Begin cutting as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, and complete before shrinkage stresses become sufficient to produce cracking.
5. Consolidation:
 - a. Thoroughly consolidate concrete. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.
6. Finishes:
 - a. When type of finish is not specified otherwise, provide the following:
 - 1) Floated finish: For surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo: Class B tolerance.
 - 2) Troweled finish: For floors intended as walking surfaces or for reception of floor coverings: Class A tolerance.

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- 3) Broom or belt finish: For sidewalks and garage floors and ramps: Class A tolerance.
 - 4) Nonslip finish: For exterior platforms, steps, and landings; and for exterior and interior pedestrian ramps: Class A tolerance.
 - 5) All floors to receive a sealed concrete finish shall receive two coats of Tnemec CT Densyfer or ChemMaster Duraguard 300 polyurethane dust proofer and sealer, color clear.
- b. Finishing tolerances:
- 1) Finishes with Class A tolerances shall be true planes within 1/8 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
 - 2) Finishes with Class B tolerance shall be true planes within 3/16 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
- N. Curing and Protection:
1. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.
 2. For interior slabs that will not be covered, topped, or painted, apply a combination floor sealer/curing compound (ASTM C309, Fed. Spec. TT-C-800A) in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing is to be performed by a firm appointed and paid for by the Owner. When additional testing of materials or concrete is necessary because of their failure by test or inspection to meet specification requirements, the cost of the additional testing shall be paid for by the Contractor. Additional testing for early form removal shall also be paid for by the Contractor.
- B. Provide access to all portions of the work and any necessary assistance in obtaining and handling samples at the project or other material sources. Three concrete test cylinders will be taken for every 50 cubic yards, or fraction thereof, for each class of concrete placed in any one day. One additional cylinder will be taken during cold weather concreting and be cured on the project site under the same conditions as the concrete it represents. One slump test will be taken for each set of cylinders taken.

3.3 SCHEDULES

- A. Specification Requirements for Concrete.
- B. Tolerances for Formed Surfaces:

Cast-in-Place Concrete

SCHEDULE A
SPECIFICATION REQUIREMENTS FOR CONCRETE

| USE CATEGORY | CEMENT TYPE | MINIMUM CEMENT CONTENT | COARSE AGGREGATE | MINIMUM MAXIMUM WATER/CEMENT RATIO* | ENTRAIN ED AIR CONTENT | MAXIMUM SLUMP | COMPRESSIVE STRENGTH Fc' |
|--|--------------------------|------------------------|------------------|-------------------------------------|------------------------|---------------|--------------------------|
| | | sacks/cyd | MDOT | gal/sack | % | inches | psi |
| Interior Floors: | | | | | | | |
| a. Residential | I, IP | 5.5 | 6A | 5.5 | — | 4 | 3500 |
| b. Industrial - garage | I, IP, IA, IP-A | 5.5 | 6A | 5.5 | 5 - 7 | 3 | 4000 |
| c. Industrial and Commercial | I, IP, IA, IP-A | 5.5 | 6A | 5.5 | 2 - 3 | 3 | 4000 |
| d. Precast Topping | I, IP, IA, IP-A | 6.0 | 25A | 5.5 | 5 - 7 | 4 | 4000 |
| Exterior - Slab on Grade: | | | | | | | |
| a. Sidewalk and Pavement | I, IP, IA, IP-A | 6.0 | 6AA | 5.0 | 5 - 7 | 3 | 3500 |
| Interior: | | | | | | | |
| a. Liquid Containing Structures | I, IP, IA, IP-A | 6.0 | 6AA | 5.5 | 5 - 7 | 4 | 5000 |
| b. Exposed to raw sewage or aggressive solutions | IP, II, V, IP-A, IIA, VA | 6.0 | 6AA | 5.0 | 5 - 7 | 4 | 5000 |
| c. Beams, Columns, and Walls | I, IP | 5.5 | 6A | 6.0 | — | 4 | 5000 |
| Exterior:** | | | | | | | |
| a. Liquid Containing Structures | I, IP, IA, IP-A | 6.0 | 6AA | 5.5 | 5 - 7 | 4 | 5000 |
| b. Exposed to raw sewage or aggressive solutions | IP, II, V, IP-A, IIA, VA | 6.0 | 6AA | 5.0 | 5 - 7 | 4 | 5000 |
| c. Beams, Columns, and Walls | I, IP, IA, IP-A | 6.0 | 6A | 5.0 | 5 - 7 | 4 | 5000 |
| d. Architectural | I, IP, IA, IP-A | 5.5 | *** | 5.5 | 5 - 7 | 4 | 3500 |
| Footings: | I, IP | 5.5 | 6A | 6.0 | — | 3 | 3500 |

*Water Cement Ratio: 5.0 gal/sack = 0.44 lbs/lb; 5.5 gal/sack = 0.48 lbs/lb; 6.0 gal/sack = 0.53 lbs/lb.

**Exterior: Exterior exposure on any side.

***Maximum Coarse Aggregate size shall be compatible with the form liner and placing methods to be used.

SCHEDULE B

TOLERANCES FOR FORMED SURFACES

| | | | |
|----|---|--|------------|
| 1. | Variation from plumb: | | |
| | A. | In the lines and surfaces of columns, piers, walls, and in arises: | |
| | | In any 10 foot of length | 1/4 inch |
| | | Maximum for the entire length | 1 inch |
| | B. | For exposed corner columns, control joint grooves, and other conspicuous lines: | |
| | | In any 20 foot length | 3/8 inch |
| | | Maximum for the entire length | 3/4 inch |
| 2. | Variation from the level or from the grades specified in the contract documents: | | |
| | A. | In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores: | |
| | | In any 10 foot of length | 1/4 inch |
| | | In any bay or in any 20 foot length | 3/8 inch |
| | | Maximum for the entire length | 3/4 inch |
| | B. | In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines: | |
| | | In any bay or in any 20 foot length | 3/8 inch |
| | | Maximum for the entire length | 3/4 inch |
| 3. | Variation of the liner building lines from established position in plan and related position of columns, walls, and partitions: | | |
| | | In any bay | 1/4 inch |
| | | In any 20 foot of length | 1/2 inch |
| | | Maximum for the entire length | 1 inch |
| 4. | Variation in the sizes and location of sleeves, floor openings, and wall openings | | +3 inch |
| 5. | Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls: | | |
| | | Minus | 3/8 inch |
| | | Plus | 1/2 inch |
| 6. | Footings* | | |
| | A. | Variations in dimensions in plan: | |
| | | Minus | 1/2 inch |
| | | Plus | 1/2 inch |
| | B. | Misplacement or eccentricity: | |
| | | 2 percent of the footing width in the direction of misplacement but not more than | 1/2 inch |
| | C. | Thickness: | |
| | | Decrease in specified thickness | 5 percent |
| | | Increase in specified thickness | No limit |
| 7. | Variation in steps: | | |
| | A. | In a flight of stairs: | |
| | | Rise | +1/8 inch |
| | | Tread | +3/8 inch |
| | B. | In consecutive steps: | |
| | | Rise | +1/16 inch |
| | | Tread | +1/8 inch |

*Tolerances apply to concrete dimensions only, not to be positions of vertical reinforcing steel, dowels, or embedded items.

End of Section

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Grouting

Section 03 60 00 – GROUTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these Specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

A. Section Includes:

1. Portland cement grout.
2. Rapid-curing epoxy grout.
3. Non-shrink cementitious grout.

B. Related Requirements:

1. Section 03 10 00 Concrete Forming and Accessories: Form materials, waterstops, and accessories as required to form cast-in-place concrete and maintain structural integrity until stripping.
2. Section 03 30 00 Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Section 01 29 76 Progress Payment Procedures.

B. Grout:

1. Basis of Measurement: lump sum.
2. Basis of Payment: Includes preparation of substrate and grout, placement, consolidation, troweling, and curing.

1.4 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 – Specifications for Structural Concrete for Buildings.

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2. ACI 301M – Specifications for Structural Concrete (Metric).
 3. ACI 318 – Building Code Requirements for Structural Concrete.
 4. ACI 318M – Metric Building Code Requirements for Structural Concrete.
- B. ASTM International:
1. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
 2. ASTM C40/C40M – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
 3. ASTM C150/C150M – Standard Specification for Portland Cement.
 4. ASTM C191 – Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
 5. ASTM C307 – Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 6. ASTM C531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 7. ASTM C579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 8. ASTM C827/C827M – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
- C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
1. CRD-C621 – Non-Shrink Grout.

1.5 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding grout.
- C. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and non-shrink grouts.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

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F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI standards.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 65 00 Product Delivery and Section 01 66 00 Product Storage and Handling: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

1.9 AMBIENT CONDITIONS

- A. Section 01 50 00 Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Maximum Conditions: Do not perform grouting if temperatures exceed 100°F.
- C. Minimum Conditions: Maintain minimum temperature of 40°F before, during, and after grouting, until grout has set.

PART 2 – PRODUCTS

2.1 PORTLAND CEMENT GROUT

- A. Portland Cement: Comply with ASTM C150/C150M, Type I and II.

Grouting

B. Water:

1. Potable.
2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:
 - a. Corrosion of steel.
 - b. Volume change increasing shrinkage cracking.
 - c. Efflorescence.
 - d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.
2. Gradation:
 - a. Comply with ASTM C33/C33M.
 - b. Represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities according to ASTM C40/C40M.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

E. Performance:

1. Compressive strength:
 - a. Minimum 7,000 psi (48.3 MPa) at 28 days.

2.2 RAPID-CURING EPOXY GROUT

A. Description:

1. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
2. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.

B. Performance and Design Criteria:

1. Compressive Strength:
 - a. 12,000 psi (82.7 MPa) at seven days.
 - b. Comply with ASTM C579.

Grouting

2. Minimum Tensile Strength:
 - a. 2,000 psi (13.8 MPa).
 - b. Comply with ASTM C307.
3. Coefficient of Expansion:
 - a. 30×10^{-6} inch per degree F (54×10^{-5} mm per degree C).
 - b. Comply with ASTM C531.
4. Shrinkage:
 - a. None.
 - b. Comply with ASTM C827/C827M.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Non-shrink, non-corrosive, nonmetallic, non-gas forming, and no chlorides.

B. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to CRD-C621 for Type D nonshrink grout:
 - a. Setting Time:
 - 1) Initial: Approximately two hours.
 - 2) Final: Approximately three hours.
 - 3) Comply with ASTM C191.
 - b. Maximum Expansion: 0.10 to 0.40 percent.
 - c. Compressive Strength:
 - 1) One-Day: 4,000 psi (27.6 MPa).
 - 2) Seven-Day: 7,000 psi (48.3 MPa).
 - 3) 28-Day: 10,000 to 10,800 psi (69.0 to 74.5 MPa).
 - 4) Comply with CRD-C621.

2.4 FORMWORK

- A. As specified in Section 03 10 00 Concrete Forming and Accessories.

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PART 3 – EXECUTION

3.1 EXAMINATION

- A. Section 01 77 00 Closeout Procedures: Procedures for installation examination.
- B. Verify areas to receive grout.

3.2 PREPARATION

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for installation preparation.
- B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.
- C. Roughen concrete lightly, but not to interfere with placement of grout.
- D. Remove foreign materials from metal surfaces in contact with grout.
- E. Align, level, and maintain final positioning of components to be grouted.
- F. Saturate concrete surfaces with clean water, and then remove excess water.

3.3 INSTALLATION

- A. Formwork:
 - 1. Construct leakproof forms anchored and shored to withstand grout pressures.
 - 2. Install formwork with clearances to permit proper placement of grout.
 - 3. As specified in Section 03 10 00 Concrete Forming and Accessories.
- B. Mixing:
 - 1. Portland Cement Grout:
 - a. Use proportions of two parts sand and one part cement, measured by volume.
 - b. Prepare grout with water to obtain consistency to permit placing and packing.
 - c. Mix water and grout in two steps:
 - 1) Premix using approximately 2/3 ratio of water to dry grout mix.
 - 2) After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.

Grouting

- d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
 - e. Do not add additional water after grout has been mixed.
 - f. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
2. Rapid-Curing Epoxy Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
 3. Non-shrink Cementitious Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
 4. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.
- C. Placing of Grout:
1. Place grout material quickly and continuously.
 2. Do not use pneumatic-pressure or dry-packing methods.
 3. Apply grout from one side only to avoid entrapping air.
 4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
 5. Thoroughly compact final installation and eliminate air pockets.
 6. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. Curing:
1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.
 2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
 3. After grout has attained its initial set, keep damp for minimum three days.
- 3.4 FIELD QUALITY CONTROL
- A. Section 01 45 00 Quality Control: Requirements for inspecting and testing.

Grouting

B. Inspection and Testing:

1. Comply with ACI 301 and as specified in Section 01 40 00 Quality Requirements.
2. Submit proposed mix design of each class of grout to Engineer of Record for review prior to commencement of Work.
3. Tests of grout components may be performed to ensure compliance with specified requirements.

End of Section

Post Installed Anchors

Section 03 70 00 – POST INSTALLED ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

- A. Section includes post installed concrete anchors requirements for the following:
 - 1. Mechanical Anchors.
 - 2. Adhesive Anchors.
- B. Related Sections:
 - 1. Division 03 Section "Cast-In-Place Concrete."
 - 2. Division 05 Section "Structural Steel Framing."

1.3 DEFINITION

- A. Post Installed Anchors: Anchors installed into hardened concrete or fully constructed hollow or grouted masonry.

1.4 REFERENCE MATERIAL

- A. ACI 318 – Building Code Requirements for Structural Concrete
- B. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete
- C. ASTM A36 – Standard Specification for Carbon Structural Steel
- D. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- E. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
- F. ASTM C881 – Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete

Post Installed Anchors

- G. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
- H. ASTM E1512 – Standard Test Methods for Testing Bond Performance of Bonded Anchors
- I. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- J. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
- K. ICC-ES AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Concrete or Masonry Elements
- L. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- M. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.5 SUBMITTAL

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
 - 1. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
 - 2. Quality Assurance Submittals:
 - a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - b. Certificates
 - 1) ICC ES Evaluation Reports
- B. Manufacturer’s installation instructions.
- C. Installer Qualifications & Procedures: Submit installer qualifications to special inspector for approval prior to commencement of work.

1.6 QUALITY ASSURANCE

- A. Installer(s) Training:
 - 1. Product Manufacturer’s certificate for each installer certifying they have been trained on the means and methods for installing the particular anchor.
- B. For horizontal and upwardly inclined adhesive installations, the installer shall be certified by an ACI/CRSI Adhesive Anchor Installing Certification Program or equivalent.

Post Installed Anchors

- C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications.
 - 1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.
- B. General: Comply with Division 1 Section–Product Storage and Handling Requirements
 - 1. Store anchors in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. All products are based on Hilti Corporation.
- B. Substitution:
 - 1. Upon approval by the engineer, the installer may substitute a product by a different manufacturer, provided that the manufacturer submits calculations signed and sealed by an engineer registered in the state of the project's location.
 - a. These calculations must show that the strength of the substituted anchor meets or exceeds the strength of the specified anchor at each application in the project where a substituted anchor is proposed, with consideration for combined stress and any applicable reduction factors.
- C. The substitution request and submittal shall be made a minimum of 2 weeks prior to planned installation of the anchors.
- D. The finish of the anchor shall remain the same as specified.

2.2 MECHANICAL ANCHORS

- A. Torque Controlled (TC) Anchors. Hilti Kwik Bolt TZ2 is a torque controlled expansion anchor suited to seismic and cracked concrete applications.
 - 1. Size: As indicated on drawings
 - 2. Finish: Plain carbon steel or Stainless Steel type 316 as indicated on drawings.

Post Installed Anchors

- B. Screw Anchors: Hilti Kwik HUS-EZ anchors are comprised of a body with hex washer head.
 - 1. Size: As indicated on drawings
 - 2. Finish: As indicated on drawings
- C. Sleeve Anchors: Hilti HLC Sleeve Anchor are mechanical expansion anchors consisting of an externally threaded stud with an expanding sleeve for use in concrete and hollow and solid masonry base material.
 - 1. Size: As indicated on drawings
 - 2. Finish: As indicated on drawings

2.3 ADHESIVE ANCHORS

- A. In contract documents adhesive anchors may be generically referred to as epoxy anchors. Where this is the case the word adhesive should be substituted for epoxy.
- B. Adhesive anchors used in concrete under a tension condition cannot be installed until after the concrete has cured for a minimum 21 days in accordance with ACI 17.4.5.2.
- C. Concrete Anchor
 - 1. Hilti HIT-RE 500-V3 is a high strength, two part epoxy adhesive.
 - a. Base material temperature range: 23 degrees up to 120 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1.25" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material: HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
 - 2. Hilti HIT HY 200 V3 is a two-component hybrid adhesive.
 - a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material: HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
 - 3. Hilti HIT HY 200 V3 Safeset is a two-component hybrid adhesive.
 - a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material based on cleaning:
 - 1) No cleaning of hole:
 - a) HIT-Z, HIT-Z-R Threaded Rods
 - 2) Automatic cleaning of hole:
 - a) HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.

PART 3 - EXECUTION

3.1 POST INSTALLED ANCHORS

- A. All installation into concrete and masonry shall be done in accordance with manufacturer's ICC-ES report.
- B. Drilling:
 - 1. Drill holes with rotary impact hammer drills. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
 - 2. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
 - 3. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has met Manufacturer's specifications.
- C. Torque Controlled Anchors and Sleeve Anchors: Protect threads from damage during anchor installation. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10 percent of the specified torque, 100 percent of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
- D. Screw Anchors: Install screw anchors to a snug tight condition unless noted otherwise.
- E. Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.2 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Continuous special Inspection of post-installed concrete and masonry anchors shall be provided as required by ICC-ES evaluation reports. This service shall be performed by personnel independent of the Manufacturer or Contractor so as to prevent a conflict of interest.

Post Installed Anchors

- C. The Engineer or Architect of Record may require pullout or shear tests, in addition to Special Inspection, to determine the adequacy of anchors. A field testing program shall be established by the independent testing and inspecting agency and/or Engineer of Record and performed in accordance with appropriate ASTM test standards. Field tests shall be non-destructive whenever possible.

End of Section

Structural Steel Framing

Section 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Stainless steel.
3. Shrinkage-resistant grout (under structural steel framing members).

B. Related Requirements:

1. Section 05 31 00 Steel Decking.
2. Section 05 50 00 Metal Fabrications for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 09 96 11 Protective Coatings for painting requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

Structural Steel Framing

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Etching cleaner.
8. Galvanized repair paint.
9. Shrinkage-resistant grout.

- B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.

- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

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- D. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Welding certificates: Provide certificates to testing/inspection agency for their use.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Mill test reports for structural-steel materials, including chemical and physical properties.
- D. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout
- E. Certified letter stating that they have done a survey of existing conditions.
- F. Source quality-control reports.
- G. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172), or a fabricator that can provide documentation that their process meets or exceeds AISC standards.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.

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- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M (Stainless Steel).
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents, refer to the local building code to determine the applicable version:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.
 - 3. ANSI/AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

Structural Steel Framing

- B. Simple shear connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Where beam end reactions are not shown provide connections capable of resisting one half the “Maximum Total Uniform Load” table value for a given beam size and span provided in AISC’s Steel Construction Manual.
 - 3. Use Allowable Stress Design; data are given at service-load level.
- C. Moment and bracing connections: Provide connections required by the Contract Documents and AISC 360.
 - 1. All bolts to be considered slip critical, except in end plate connections where pre-tensioned bolts shall be used.
 - 2. For all complete joint penetration welds (CJP) select the appropriate type of weld per AWS to complete the connection.
 - 3. Provide welded shim plates as needed for all flange plate connections.
- D. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M or ASTM A572/A572M, Grade 50.
- B. Channels, Angles, M, S-Shapes: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M.
- D. Cold-Formed Hollow Structural Sections and steel pipe: ASTM A500/A500M, Grade B or ASTM A500/A500M, Grade C structural tubing.
- E. Stainless Steel Shapes: ASTM A276/A276M, Type 316L.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

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- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Twist-Off Type Tension Control Bolts: ASTM F1852
- C. Stainless Steel Bolts and Nuts, to be used where fastening Stainless Steel: ASTM F592 and ASTM F594, Type 316L.

2.4 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A563 heavy carbon steel.
 - 3. Plate Washers: ASTM A36/A36M carbon steel.
 - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
- B. Threaded Rods: ASTM A36/A36M.
 - 1. Nuts: ASTM A 63 heavy carbon steel.
 - 2. Washers: ASTM F436, Type 1, hardened or ASTM A36/A36M carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.

2.5 PRIMER

- A. Galvanized-Steel Primer: MPI#26, MPI#80, MPI#134.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A780/A780M.

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2.6 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal (plasma or laser) cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- G. Welded-Steel Door Frames: Build up welded-steel door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.

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- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: as indicated on plans.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize all structural steel, including connections and anchor bolts, unless indicated otherwise on drawings.

2.10 SURFACE PREPARATION AND SHOP PRIMING

- A. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming and/or field coatings by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- B. Priming (if required): Immediately after galvanization process and surface preparation, apply primer in accordance with the written instructions of the manufacturer of both the

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primer and the high-performance coating. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

- A. If one of the two conditions below is followed then source quality control need not be required provided approved by building official:
1. The fabricator is AISC certified and provides documentation they are approved to perform such work without special inspection, and at the completion of fabrication the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.
 2. The fabrication process does not require any welding, thermal cutting, heating operations of any kind. In such cases the fabricator shall submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, grade and mill test reports for the main stress-carrying elements are capable of being determined.
- B. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. High-Strength Bolts pretensioned and slip critical: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt, type of joint specified, and as follows
 - a. Prepare surface as required for type of joint specified.
 - b. Install specification approved bolt or washer type connection.
 - c. For Direct Tension Indicators tighten connection with all needed washers as indicated in installation instructions.
 - d. All bolt installation shall be done under the direct supervision of an inspector or shop certified quality control individual
 3. Welded Connections: All welds will be 100 percent visually inspected, in addition to visual inspection 10 percent of shop-welded connections and 100 percent of all complete or partial penetration welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.

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4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.

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2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts snug tightened unless indicated: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and for snug tightened joint.
- B. High-Strength Bolts pretensioned and slip critical: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt, type of joint specified, and as follows
1. Prepare surface as required for type of joint specified.
 2. Install specification approved bolt or washer type connection.
 3. For Direct Tension Indicators tighten connection with all needed washers as indicated in installation instructions.
 4. All bolt installation shall be done under the direct supervision of an inspector

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- C. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. High-Strength Bolts pretensioned and slip critical: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt, type of joint specified, and as follows
 - a. Prepare surface as required for type of joint specified.
 - b. Install specification approved bolt or washer type connection.
 - c. For Direct Tension Indicators tighten connection with all needed washers as indicated in installation instructions.
 - d. All bolt installation shall be done under the direct supervision of an inspector or shop certified quality control individual.
 3. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to 100 percent visual inspection, 10 percent of all field fillet welds and 100 percent all complete or partial penetration welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.

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- 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- 3) Ultrasonic Inspection: ASTM E164.
- 4) Radiographic Inspection: ASTM E94/E94M.

3.6 PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Clean and prepare surfaces in accordance with the written instructions of the manufacturer of both the primer and the high-performance coating.
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 09 96 11 Protective Coatings.

End of Section

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Steel Decking

Section 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.

- B. Related Requirements:

- 1. Section 05 12 00

- 2. "Structural Steel Framing."

- 3. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates for special inspectors use.

- B. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.

- C. Evaluation Reports: For steel deck, from ICC-ES.

Steel Decking

- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, minimum, G90 zinc coating.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Side Laps: As indicated.

Steel Decking

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- G. Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. Coordinate recess and slope requirements with Architectural details. For drains, cut holes in the field.
- H. Galvanizing Repair Paint: ASTM A780/A780M, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.

Steel Decking

- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members as indicated on plans:
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated on drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch-long welds.
 - 3. For specific information on spacing and attachment see drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
 - 1. Attach cover plates at changes in direction of roof-deck panels unless otherwise indicated.

Steel Decking

- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

End of Section

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Cold-Formed Metal Framing

Section 05 40 00 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

- A. Section Includes:

- 1. Exterior non-load-bearing wall framing.

- B. Related Requirements:

- 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

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

- B. Shop Drawings:

- 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

- C. Delegated-Design Submittal: For cold-formed steel framing. Shop drawings and engineering analysis and design data shall be signed and sealed by the licensed professional engineer responsible for their preparation.

Cold-Formed Metal Framing

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- E. Evaluation Reports: For nonstandard cold-formed steel framing, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

Cold-Formed Metal Framing

- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, must provide documentation that they have been performing such work for a minimum of 5 years.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design framing for loads indicated on drawings and/or for loads imposed on the framing by other trades or materials including all eccentricities.
 - 2. The contractor is responsible for coordinating all loading methods and locations imposed on to the cold form metal framing.
 - 3. The design of the framing shall follow all local, state, and federal building codes.
 - 4. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - 5. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 6. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.
 - 7. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

Cold-Formed Metal Framing

- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Wall Studs: AISI S211.
 - 2. Headers: AISI S212.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90, A60, AZ50, or GF30.
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness:
 - a. Metal Panel backup: As required by design, with a minimum as required by the metal panel supplier.
 - b. All other materials: As required by design.
 - 2. Flange Width: as required by design.
 - 3. Section Properties: as required by design.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: Manufactures standard unless otherwise indicated.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

Cold-Formed Metal Framing

- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: Manufactures standard unless otherwise indicated.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Hole-reinforcing plates.
 - 10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- A. Anchor Bolts: ASTM F 1554, Grade 36 weldable, threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

Cold-Formed Metal Framing

- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled expansion anchor, Mechanical anchor, Torque-controlled adhesive anchor or adhesive anchor.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 4. Material for Locations and Where Stainless Steel Is Indicated: Stainless-Steel bolts, ASTM F593, and nuts, ASTM F594.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B, or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

Cold-Formed Metal Framing

2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

Cold-Formed Metal Framing

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

Cold-Formed Metal Framing

- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Cold-Formed Metal Framing

- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

End of Section

SECTION 05 50 00 - MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers the fabrication and erection of miscellaneous metal items not covered in other sections.
- B. The items covered by this section include, but are not limited to, the following:
 - 1. Metal framing and supports for door frames made of structural shapes.
 - 2. Metal framing and supports for mechanical and electrical equipment.
 - 3. Metal shapes used at door sills.
 - 4. Metal shapes used for applications not indicated in other sections.
 - 5. Metal ladders and fall protection safety systems.

1.2 SUBMITTALS.

- A. Drawings and Data
 - 1. Complete data, fabrication drawings, and setting or erection drawings covering all miscellaneous metal items shall be submitted in accordance with the Submittal Procedures section.
- B. Connection and Welding Details
 - 1. All bolted connections and welds shall be properly identified on the shop drawings. Welding procedures, welding procedure qualification records and welder qualifications shall be submitted.
- C. Ladder Data and Calculations
 - 1. Submittals for ladders that are designed by the fabricator shall include drawings sealed by a professional engineer registered in the state of the project. Data shall include confirmation that the design meets all applicable code requirements. Calculations shall be submitted when requested by Engineer.

1.3 DELIVERY, STORAGE, AND HANDLING.

- A. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, significant coating damage, or corrosion. Damaged materials shall be promptly replaced.

Miscellaneous Metal Fabrications

Miscellaneous metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

PART 2 - PRODUCTS

2.1 GENERAL.

- A. All miscellaneous metals shall be detailed and fabricated to facilitate installation as indicated on the drawings. All required field connection materials shall be furnished.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS.

- A. Ladders shall be designed by a professional engineer registered in the state of the project. The design shall meet the requirements of OSHA Section 1910.27 and ANSI A14.3. Ladders with climbing heights greater than 24 feet, or where the length of climb is less than 24 feet but the top of the ladder is more than 24 feet above the ground, floor, or roof level, shall be provided with a fall protection safety system as indicated on the Drawings. Ladders with fall protection safety systems shall have the ladder and anchorage designed to resist the associated design level impact forces. Rest platforms shall be provided to limit straight climb lengths to 30 feet.

2.3 MATERIALS.

Steel

| | |
|--|---|
| Shapes, Plates, and Bars | ASTM A36. |
| Sheets | ASTM A1008 CS Type B or A1011 CS Type B. |
| Pipe | ASTM A53, Type E or S, Grade B ($F_y = 35$ ksi). |
| Round Structural Tubing | ASTM A500, Grade C ($F_y = 46$ ksi). |
| Square and Rectangular Structural Tubing | ASTM A500, Grade C ($F_y = 50$ ksi). |

Fasteners

| | |
|-------------------|--|
| Bolts, Unfinished | ASTM A307. |
| Nuts, Heavy-Hex | ASTM A563, grade and finish compatible with bolts. |
| Washers | Flat, hardened, ASTM F436, Type 1. |

Miscellaneous Metal Fabrications

| | |
|---------------------------------------|--|
| Forged Steel Clevises and Turnbuckles | AISI C-1035. |
| Forged Steel Eyebolts and Eyenuts | AISI C-1030, ANSI B 18.15 Type 2 shoulder pattern unless otherwise required. |
| Weld Metal (Steel Connections) | ANSI/AWS D1.1, Table 3.1, filler metal with minimum 70 ksi tensile strength unless otherwise required. |
| Headed Concrete Anchors | ASTM A108 with a minimum 50,000 psi yield strength and minimum 60,000 psi tensile strength. TRW/Nelson or equal. |
| Deformed Bar Anchors | ASTM A496 with a minimum 70,000 psi yield strength and minimum 80,000 psi tensile strength. TRW/Nelson division or equal. |
| Ladders | |
| Aluminum | Siderails shall be continuous and spaced as indicated on the Drawings. Rungs shall be extruded aluminum tubes, with shape and minimum size as indicated on the Drawings. |
| Body Solder | Flux-core wire, ASTM B32, Alloy Grade 20B. |
| Shop Coatings | |
| Universal Primer | As indicated in the Protective Coatings section. |
| Galvanizing | ASTM A123, A153, A385, and F2329 as applicable. |

2.4 FABRICATION.

A. General.

1. Items shall be preassembled in the shop to greatest extent possible. Metals shall be cut, drilled, and punched cleanly and accurately. Sharp or rough edges on exposed surfaces shall be removed.

B. Fasteners.

Miscellaneous Metal Fabrications

1. Unless indicated otherwise on the Drawings, stainless steel fasteners shall be used for fastening aluminum or stainless steel, steel fasteners shall be used for fastening steel, and bronze fasteners shall be used for fastening bronze.

C. Bearing and Leveling Plates.

1. Loose bearing and leveling plates for steel items bearing on masonry or concrete shall be hot-dip galvanized.

D. Ladders.

1. Unless otherwise indicated on the Drawings, all ladders provided under this section shall be of the same type and design.
2. Ladders, fall protection safety systems, and rest platforms shall be provided as indicated on the Drawings. Ladder rails intersecting guardrailing shall be configured to provide an aesthetically pleasing transition, although ladder rails need not be physically attached to the guardrailing. There shall be no gaps between ladder rails and adjacent guardrailing that would allow passage of a sphere greater than 4 inches in diameter.
3. Ladders exiting through hatchways shall be furnished with extending ladder safety posts.

2.5 SHOP COATING.

- A. All miscellaneous metal items shall be shop coated as specified herein, except as otherwise indicated. The requirements for field painting are covered in the Protective Coatings section.

- B. Contact surfaces of miscellaneous metals that are to be field welded shall be masked so that no shop primer or galvanizing will be applied in the vicinity of the weld.

C. Cleaning.

1. Surfaces shall be dry and of proper temperature when coated, and shall be free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by solvent, high-speed power wire brushing or by blasting to the extent recommended by the shop coating manufacturer.

D. Edge Grinding.

1. Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius as needed to ensure satisfactory shop coating adherence.

E. Galvanizing.

1. Unless otherwise indicated herein or on the Drawings, all steel in exterior locations shall be galvanized. All galvanizing shall be done by the hot-dip process after fabrication. An approved zinc-rich paint shall be used to touch up minor coating damage, in accordance

Miscellaneous Metal Fabrications

with ASTM A780. Materials with significant coating damage shall be regalvanized or replaced.

2. Bolts, nuts, and washers shall be galvanized when connected materials are galvanized or where indicated on the Drawings. The use of zinc-plated bolts will not be acceptable.

F. Prime Painted Steel.

1. Unless otherwise specified or indicated on the Drawings, all ungalvanized steel shall be given a shop coat of universal primer after fabrication. The dry film thickness of the universal primer shall be at least 5 mils. Steel surfaces shall be coated as soon as practicable after cleaning. Steel shall not be moved or handled until the shop coat is dry and hard.

G. Aluminum.

1. All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of bituminous paint.

H. Castings.

1. Shop coating of miscellaneous iron castings will not be required.

I. Other Surfaces.

1. Painting of zinc coated steel or bronze surfaces will not be required.

PART 3 - EXECUTION

3.1 GENERAL.

- A. Miscellaneous metals shall be placed in accurate location, alignment, and elevation. Edges and surfaces shall be free of warps, local deformations, and unauthorized bends. Connections shall be accurately fitted.
- B. Field welding or cutting shall not be performed on galvanized or primed surfaces.

3.2 BOLTED CONNECTIONS.

- A. Unless otherwise indicated on the Drawings all bolted connections shall be snug tight.

3.3 WELDING.

- A. Welds that are exposed to view shall be ground smooth. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

Miscellaneous Metal Fabrications

- B. Surfaces within 2 inches of a weld shall be free from loose or thick scale, slag, rust, moisture, grease, paint and other foreign materials that would prevent proper welding or release objectionable fumes.
- C. Deformed bar anchors, headed concrete anchors, and shear connectors shall be welded with an automatic stud welding gun per the manufacturer's recommendation. Hand welding will not be acceptable.

3.4 BEARING AND LEVELING PLATES.

- A. Bearing and leveling plates shall have the bottom surfaces cleaned prior to installation. Plates shall be set on wedges or leveling nuts, and after positioning and leveling, anchor bolts shall be tightened. Grout shall be placed solidly below plates with no remaining voids.

3.5 STOP PLATES AND GROOVES.

- A. Stop plate grooves shall be installed plumb and straight within a tolerance of 3/32 inch and with the opposite sides and bottom aligned in a single plane to prevent binding of the stop plate. If necessary to meet this requirement, a space shall be boxed out for guides, and the guides grouted in place later. Stop plates shall be set in place as needed for testing and startup procedures.

End of Section

Structural Metals

SECTION 05 50 13 - STRUCTURAL METALS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the fabrication and erection of structural metal items.
- B. Except as otherwise specified or indicated on the Drawings, all work shall conform to the applicable provisions of the AISC “Steel Construction Manual” (14th edition) with the exception of the “Code of Standard Practice for Steel Buildings and Bridges”; and the Aluminum Association “Specification for Aluminum Structures.”
- C. Special inspection during the fabrication and erection of structural steel, if required by the local building code, is addressed in the Code-Required Special Inspections and Procedures section.

1.2 SUBMITTALS

- A. Drawings and Data - General
 - 1. Complete data, fabrication drawings, and setting or erection drawings covering all structural and miscellaneous metal items shall be submitted in accordance with the Submittals Procedures section.
- B. Connection and Weld Data
 - 1. All bolted connections and welds shall be properly identified on the shop drawings. Welding procedures, welding procedure qualification records and welder qualifications shall be submitted.
- C. Bolts and Washer Data
 - 1. Submittals for high strength bolts, tension control bolts and load indicator washers shall include statements from the bolt and washer manufacturers certifying satisfactory compliance with the governing standards and the specified tests.
- D. Drawings and Data – Design
 - 1. Submittals for items that are designed by the fabricator shall include drawings sealed by a professional engineer registered in the state of the project. Data shall include confirmation that the design meets all applicable code requirements. Calculations shall be submitted when requested by Engineer.

Structural Metals

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, significant coating damage, or corrosion. Damaged materials shall be promptly replaced. Structural and miscellaneous metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.
- B. Bolting materials shall be stored indoors. Weld rod shall be stored in accordance with the supplier's instructions and AWS D1.1.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials needed for both shop and field assembly shall be furnished.

2.2 MATERIALS

Aluminum

| | |
|--------------------------------|---|
| Sheet and Plate | ASTM B209, Alloy 6061-T6. |
| Rolled Sections | ASTM B308, Alloy 6061-T6. All members shall be Aluminum Association standard shapes. Special shapes with sloping flange surfaces, or Army-Navy type members, shall not be used unless specifically indicated on the Drawings. |
| Rod and Bar (Rolled or Drawn) | ASTM B211, Alloy 6061-T6 or 2017-T4. |
| Extrusions | ASTM B221, Alloy 6063-T5 or T6. |
| Pipe | ASTM B429, Alloy 6061-T6. |
| Rivets | ASTM B316, Alloy 6061-T6. |
| Bolts, Aluminum | ASTM F468, Alloy 2024-T4. |
| Nuts, Aluminum | ASTM F467, Alloy 6061-T6. |
| Washers, Aluminum | |
| Flat | ANSI/ASME B18.22.1, Type 6061 T-6. |
| Lock | ANSI/ASME B18.21.1, helical spring type, Type 6061-T6. |
| Weld Metal (Steel Connections) | ANSI/AWS D1.1, Table 3.1, filler metal with minimum 70 ksi tensile strength unless otherwise required. |
| Rails | |
| Crane | ASTM A1. |

Structural Metals

| | |
|------------------|--|
| Railroad | ASTM A1. |
| Shop Coatings | |
| Universal Primer | As indicated in the Protective Coatings section. |
| Bituminous Paint | Metal fabricator's standard product. |
| Galvanizing | ASTM A123, A153, A385, and F2329 as applicable. |

2.3 STAIRS

- A. Stairs shall be fabricated to the dimensions, arrangements and sizes indicated on the Drawings. Stairs shall be true to line and slope, shall be rigidly supported, and shall be braced and tightened to prevent movement. All treads shall be level and in perfect alignment and spacing.
- B. After installation, stairs shall be rigid and shall not sway noticeably or deflect under foot traffic. If necessary to prevent noticeable movement, additional supports or bracing shall be provided.
- C. Stair Design
 - 1. Stairs and landings shall be designed by the stair supplier in general accordance with details indicated on the Drawings. The design shall comply with all applicable provisions of the local building code, ANSI A117.1, and OSHA as applicable. The drawings shall be sealed and signed by by a professional engineer registered in the state of the Michigan . If requested, calculations shall be submitted to Engineer.
 - 2. The completed fabrications shall support a uniform live load of 100 lbs per square foot and a concentrated load of 300 lbs applied at the center of the span. Individual treads and platforms shall be designed to support a uniform live load of 100 lbs per square foot or a 300 lb concentrated live load applied on an area of 4 square inches. Vertical deflections under full live load shall be limited to span/240. Stairs and landings shall be braced or otherwise designed to avoid noticeable sidesway.
 - 3. The stair design and details shall be coordinated with the handrailing and guardrailing supplied. Stair members shall be adequate to accept loads from the rail posts based upon the criteria in the Metal Railings section.
 - 4. Connections between the stair members and the supporting structure shall be adequate to transfer all loadings, and shall be designed in accordance with all applicable provisions of the AISC manual and ACI 318 Chapter 17. The number and type of connections shall comply, at a minimum, with the Drawings. All necessary brackets, bolts, and anchors shall be provided.
- D. Aluminum Grating Stairs
 - 1. Grating stair treads shall match the material and finish of grating in adjacent platforms and floors. Treads shall have a permanently attached or integral non-skid nosing. All grating shall be fabricated in accordance with the Metal Gratings section.

Structural Metals

2.4 STRUCTURAL STEEL BOLTED CONNECTIONS

- A. Bolt holes shall have a diameter nominally 1/16 inch larger than the nominal bolt diameter. Bolt holes for one ply of vertical diagonal bracing connections may be oversized to a diameter nominally 3/16 inch larger than the nominal bolt diameter.

2.5 SHOP COATING

- A. All items shall be shop coated as specified herein. The requirements for field painting are covered in the Protective Coatings section.
- B. Contact surfaces of structural steel slip critical bolted connections shall not be shop coated. Contact surfaces of structural steel bearing type bolted connections may be shop coated.
- C. Cleaning
 - 1. Surfaces shall be dry and of proper temperature when coated, and shall be free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by solvent, high-speed power wire brushing or by blasting to the extent recommended by the paint manufacturer and as required in the Protective Coatings section.
- D. Edge Grinding
 - 1. Sharp projections of cut or sheared edges of ferrous metals which will be submerged in operation, except for items specified to be hot-dip galvanized, shall be ground to a radius as needed to ensure satisfactory paint adherence and as required in the Protective Coatings section.
- E. Aluminum
 - 1. All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of bituminous paint.

PART 3 - EXECUTION

3.1 STRUCTURAL STEEL ERECTION

- A. Structural steel shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevations of the top of floor and roof members shall be within 1/16 inch of the elevations indicated on the Drawings.
- B. All members and parts, as erected, shall be free of warps, local deformations, and unauthorized bends. All parts shall be assembled accurately as indicated on the Drawings. Light drifting will be permitted to draw parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with

Structural Metals

twist drills and only with the approval of Engineer. Enlarging holes by burning will not be permitted.

C. Baseplates shall be set level in exact position and grouted in place.

D. Inspection and Testing

1. Special inspection will be performed as indicated in the Code Required Special Inspections and Procedures section. The erector shall provide access as needed to facilitate all inspections and shall provide timely notification during erection when inspection milestones are approaching.

3.2 STRUCTURAL STEEL BOLTED CONNECTIONS

- A. Unless otherwise indicated on the Drawings, bolted connections for structural steel, as defined in the AISC manual, shall be made with ASTM F3125 high strength bolts conforming to the "Specification for Structural Joints Using High-Strength Bolts" as approved by the Research Council on Structural Connections. The method of installation, pretensioning procedures, bolting equipment and tools shall likewise conform to the above referenced standard.
- B. When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts, or washers, shall be free of loose mill scale, dirt, burrs, oil, and other foreign material that would prevent solid seating of the parts.
- C. Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. Bolt length shall be increased as needed to accommodate the beveled washers.
- D. If oversized holes are provided in an outer ply, a hardened flat washer shall be installed over each hole during bolting. Load indicator washers shall not be substituted for hardened flat washers required for oversized holes.
- E. Tightening of each connection assembly shall progress systematically from the most rigid part of the joint toward the free edges until all have been sufficiently rotated or the load indicator washers on all bolts have been closed to the average gap stipulated by the load indicator washer manufacturer.
- F. Except as otherwise indicated on the Drawings or specified herein, bolted connections shall be bearing type with threads excluded from the shear plane. Slip critical connections shall be used in diagonal bracing connections, where oversize holes or slotted holes parallel to the direction of the load are used, and where indicated on the Drawings.
- G. Bolts in all structural steel connections, both bearing and slip critical, shall be fully pretensioned in accordance with the AISC standards unless specifically noted otherwise on the Drawings. The calibrated wrench method of pretensioning bolts will not be acceptable. Acceptable pretensioning methods are as follows:

| Connection Type | Acceptable Pretensioning Method |
|-----------------|--|
| Bearing | Load-indicator washers are preferable and acceptable. Tension control (twist-off) type bolts may be used only if approved by Engineer. |
| Slip-Critical | Load indicator washers. |

H. Load-Indicator Washers

1. Load indicator washers shall be installed in accordance with the manufacturer’s recommendations, as supplemented herein. To facilitate proper tightening of fastener assemblies with load indicator washers, a hardened flat washer shall be installed under the turned element (bolt head or nut) and between the turned element and the load indicator washer protrusions, in all cases. Whenever possible, the load indicator washer shall be installed on the head end of the bolt. If the bolt head will not be visible for inspection of the indicator washer after installation, or if the bolt head must be turned to tighten the assembly, the load indicator washer may be installed on the nut end of the bolt.

I. Tension Control (Twist-off) Bolts

1. Patented tension control bolts shall be of equivalent size and strength to the indicated high strength bolts, and shall be installed in strict accordance with the manufacturer’s instructions. Load-indicator washers are not required on tension control bolts.

3.3 STRUCTURAL AND MISCELLANEOUS ALUMINUM

A. Unless otherwise noted, all work shall conform to applicable provisions of the Aluminum Association “Specification for Aluminum Structures.”

B. Connections

1. Connections not specifically detailed on the Drawings shall develop the full strength of the least strength member of the connections. Bolted connections shall be all-bolted bearing type, equipped with a helical spring lock washer under the stationary element (bolt head or nut) and a flat washer under the turned element. All bolts shall be fully tightened. Bolts and nuts for structural aluminum connections shall be stainless steel. A sufficient number of bolts shall be provided in each connection to develop the shear strength of the member.
2. Welded connections shall be made in accordance with the American Welding Society D1.2, Structural Welding Code - Aluminum. All welding shall be performed by welders qualified in accordance with American Welding Society. Welds shall be free of porosity, cracks, holes, and flux. Welded connections shall not be substituted for bolted connections without prior approval of Engineer.

Structural Metals

C. Erection

1. Structural aluminum shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevation of horizontal members shall be within 1/16 inch of the elevation indicated on the Drawings.

End of Section

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Aluminum Railings

Section 05 52 10 – ALUMINUM RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these Specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

- A. Section includes aluminum pipe and tube railings, balusters, and fittings; and handrails.
- B. Related Sections:
 - 1. Section 03 30 00 Cast-In-Place Concrete: Execution requirements for placement of anchors specified in this section in concrete.
 - 2. Section 05 50 00 Metal Fabrications: Coordination.

1.3 REFERENCES

- A. Aluminum Association:
 - 1. AA ADM 1 – Aluminum Design Manual.
 - 2. AA ASM 35 – Aluminum Sheet Metal Work in Building Construction.
- B. American Architectural Manufacturers Association:
 - 1. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2604 – Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

Aluminum Railings

C. ASTM International:

1. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
2. ASTM B211M – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).
3. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. ASTM B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
5. ASTM B241/B241M – Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
6. ASTM B483/B483M – Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.

1.4 DESIGN REQUIREMENTS

- A. Design handrail, guardrail, and attachments to resist forces as required by applicable codes.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 Quality Requirements to design aluminum railings.

1.5 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Delegated-Design Submittal: For aluminum railings. Shop drawings and engineering analysis and design data shall be signed and sealed by the licensed professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Perform Work for structural aluminum in accordance with AA ADM 1 and AA ASM 35.
- C. Finish joints in accordance with NOMMA Guideline 1.

Aluminum Railings

- D. Perform Work in accordance with State of Michigan standards.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 Materials

- A. Aluminum Pipe and Tube Railing Systems: Manufacturer to be TUFRAIL, as manufactured by Thompson Fabricating, LLC (Birmingham, Alabama) or Golden Railing, Inc. 720 Corporate Circle J, Golden Colorado 80401, or approved equal.
 - 1. Extruded Structural Pipe and Tube:
 - a. Railings: 1-1/2" Schedule 40 aluminum pipe alloy 6105-T5, ASTM-B-or ASTM-B-221.
 - b. Posts: 1-1/2" Schedule 80 aluminum pipe of the same alloy. Post spacing shall be a maximum of 6'-0".
 - 2. Drawn Seamless Tube: ASTM B 210, alloy 6063 T832.
 - 3. Plate and Sheet: ASTM B 209, alloy 6061 T6.
 - 4. Die and Hand Forgings: ASTM B 247, alloy 6061 T6.
 - 5. Castings: ASTM B 26, Alloy A356 T6.
 - 6. Finish: shall be Aluminum Association M10-C22-A41 (215-R1).
 - 7. Guardrails and Handrails shall be designed to withstand 200 lb. concentrated load applied in any direction and at any point on the top rail. Guardrails and Handrails shall also be designed to withstand a uniform load of 50 lb/ft applied horizontally to the top rail.
 - 8. Intermediate railings shall be designed to not allow a 21-inch diameter sphere to pass through any opening.
 - 9. Intermediate railings shall be designed to withstand a horizontally applied load of 50 lb. on an area not to exceed one square foot, including openings and spaces between rails.
 - 10. Posts shall NOT interrupt the continuation of the top rail at any point along the railing, including the corners and end termination (OSHA 1910.23). The top surface of the top railing shall be smooth and shall not be interrupted by projected fittings.

Aluminum Railings

11. Toeboard shall conform to OSHA standards. Toeboard shall be a minimum of 4 inches high and shall be an extrusion that attaches to the posts with clamps that will allow for expansion and contraction between posts. Toeboards shall be set 1/4 inch above the walking surface.
12. Aluminum surfaces in contact with concrete, grout, or dissimilar metals will be protected with a coat of bituminous paint, Mylar isolators, or other approved material.
13. A self-closing gate shall guard openings in the railing (OSHA 1910.23). Safety chains shall not be used unless specifically shown on the drawings.
14. Finish shall be Aluminum Association M10-C22-A41 (215-R1). The pipe shall be plastic-wrapped. The plastic wrap is to be removed after erection.

B. Auxiliary Materials:

1. Non-shrink Nonmetallic Grout: CE CRD-C621.
2. Interior Anchoring Cement: Hydraulic expansion cement.
3. Exterior/Interior Anchoring Cement: Erosion resistant hydraulic expansion cement.
4. Concrete Anchors: Shall be stainless steel type 303 or 304 wedge anchors and shall be furnished by the handrail manufacturer. The anchor design shall include the appropriate reduction factors for spacing and edge distances in accordance with the manufacturer's published data.

2.2 FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to site.
- B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations not encouraging water intrusion.
- F. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

Aluminum Railings

- G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- H. Accurately form components to suit stairs and landings to each other and to building structure.
- I. Accommodate for expansion and contraction of members and building movement without damage to connections or members.
- J. Provide coatings to prevent contact of aluminum materials with bare concrete substrate. Coat with polyamide epoxy or coal-tar epoxy finish coat with manufacturer's approved primer for aluminum substrate. Apply one coat primer and one coat finish, minimum 10 mils total dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 10 00 Summary: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work. Take field measurements prior to fabrication where possible.
- C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

- A. Clean and strip aluminum where site welding is required.
- B. Supply items required to be cast into concrete and/or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Anchor railings to structure with anchors, plates, or angles, as required.
- D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Assemble with spigots and sleeves to accommodate hairline tight joints and secure installation.

Aluminum Railings

- F. Restore damaged finishes and protect work.

End of Section

Metal Railings

SECTION 05 52 13 - METAL RAILINGS

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers the design, fabrication and installation of handrailing and guardrailing fabricated from metal. FRP railing systems, concrete and masonry anchorage, structural metals, and miscellaneous metal fabrications are covered in other sections.

1.2 GENERAL.

- A. Fabricated items which are indicated on the Drawings but not mentioned specifically herein shall be fabricated in accordance with the applicable requirements of this section.

1.3 SUBMITTALS.

A. General

1. Complete data, detailed drawings, and setting or erection drawings covering all materials shall be submitted in accordance with the Submittal Procedures section. Each separate piece shall be marked.
2. Railing drawings shall be sealed by a professional engineer registered in the state of the project.
3. Data shall be submitted to certify that railings meet all applicable requirements of the codes as specified herein and the Specifications and Drawings. Engineer may request copies of all supporting calculations.

B. Samples.

1. Samples shall be submitted to indicate finishes. Samples of each type of fitting required to complete the installation shall also be submitted.

C. Colors.

1. Where color selections are required, color charts shall be submitted showing the full range of available colors. Procedures for selecting colors shall be as indicated in the Submittal Procedures section.

Metal Railings

PART 2 - PRODUCTS

2.1 GENERAL.

- A. Railing systems shall be designed and fabricated by companies normally engaged in the manufacture of such systems. Railing products shall be from a single supplier and the installed systems shall have a uniform appearance throughout the project.
- B. At Contractor's option, handrailing and guardrailing shall be either shop fabricated welded systems or prefabricated nonwelded systems designed for field assembly. Welded railing systems shall be fabricated from pipe and accessories by metal fabricators experienced in designing and fabricating welded railing.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS.

A. Railing System Design Criteria.

1. All railing systems shall be designed and fabricated in compliance with the most stringent requirements of the applicable local building code, OSHA 29 CFR Part 1926 Subpart R, and all other pertinent OSHA regulations and local safety regulations.
2. Handrails for handicapped accessible areas shall comply with the requirements of the local building code, ANSI 117.1 Uniform Federal Accessibility Standards, and the accessibility standards of the Americans with Disabilities Act.
3. In case of conflicting requirements the more stringent requirements shall be applicable.
4. At a minimum, guardrailing and handrailing shall be designed to withstand a uniform load of 50 lb per ft applied in any direction at the top, and a concentrated load of 200 lb applied in any direction at any point along the top. The uniform load and the concentrated load need not be assumed to act concurrently. The design load shall be transferred through the entire railing system and its attachment to the structure.
5. Intermediate rails, including balusters on picket-type systems, shall be designed to withstand a horizontally applied normal load of 50 lb on an area not to exceed 12 inches by 12 inches including openings and space between rails. The load shall be located so as to produce the maximum effects. Reactions due to this loading are not required to be superimposed with the loads specified for the top rail and handrail.
6. An allowable stress increase of 1/3 shall not be incorporated into the design of any part of the railing system.
7. Maximum spacing for railing posts shall be 6 ft.

B. Aluminum Rails.

Metal Railings

1. Handrails and guardrails shall be fabricated from 1-1/2 inch ID aluminum pipe. Pickets shall be fabricated from 3/4 inch ID aluminum pipe.
- C. Kickplate.
1. Kickplates shall be four inches high and shall be fabricated from similar materials as the railing. Kickplates shall clear the walking surface by 1/4 inch.
- D. Fasteners.
1. Unless noted otherwise, all fasteners shall be stainless steel. Where galvanized bolts are indicated on the Drawings or specified, the use of zinc-plated bolts will not be acceptable. Railings shall be fastened to fittings with through bolts or flush set screws; glued or pop riveted connections are not permitted. Fastener details shall be indicated on the submittal drawings.
- E. Guarding of Openings.
1. Openings in railing shall be guarded by self-closing gates in accordance with OSHA 1910.23. Gates shall be the product of a manufacturer specializing in the design of safety systems.
- F. Removable Guardrail.
1. Removable guardrail sections shall be designed so that each section has at least two, but not more than three posts.
- G. Expansion Control.
1. Guardrailing in outdoor locations shall have slip joints at least every 60 ft and at all concrete expansion joints to permit expansion and contraction. The gap at each slip joint shall be not less than 1/4 inch.
- H. Mounting to Structure.
1. Railing systems shall be mounted to structures as indicated on the Drawings. If mounting details are not indicated, railing posts shall be surface mounted with base flanges or side mount brackets secured to concrete by stainless steel adhesive anchors. Bolt sizes and pattern shall be as needed for the mounting device.
- 2.3 ACCEPTABLE MANUFACTURERS.
- A. Metal railing shall be by Julius Blum & Co, Thompson Fabricating, Kee Industrial Products, VIVA Railings, or approved equal.

2.4 MATERIALS.

Aluminum Systems

Metal Railings

| | |
|--|---|
| Pipe | ASTM B429, Alloy 6063-T6, Schedule 40 minimum thickness. |
| Plates | ASTM B209, Alloy 6061-T6. |
| Fittings, Welded | Angles, offsets, tees, ells, crosses, caps for aluminum, ASTM B429, Alloy 6063-T6, Schedule 40 minimum thickness. |
| Fittings, Non-welded | Manufacturer's standard component fittings, extruded sections, ASTM B221, Alloy 6063-T5/T52. |
| Assembly Bolts, Nuts, Washers, and Fasteners | Stainless steel. |
| Plastic Pipe Sleeves | PVC tube, Schedule 40. |
| Post Setting Cement | Minwax "Super Por-Rok Cement" or Master Builders Solutions "MasterEmaco T 545". |
| Anchorage to Concrete or Masonry | Stainless steel adhesive anchors in accordance with the Post Installed Anchors section. |
| Anodic Finish | AA-M10C22A41, clear unless otherwise required. |

2.5 FABRICATION.

- A. Unless otherwise indicated on the Drawings, all railings provided under this section shall be of the same type and design.
- B. Welded Metal Railings.
 - 1. All angles, offsets, or other changes in alignment in welded pipe railings shall be made with railing ells and welded connectors. Welded joints shall be flush type. Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Members shall be neatly coped and continuously welded or mechanically connected at all junctions. Top rails shall run continuously over posts. All rails and posts shall be in the same plane and shall not be offset. All welding shall be done neatly and substantially by a process (e.g., TIG or MIG) producing a smooth weld. All weld spatter and burrs shall be removed, and all welds shall be thoroughly brushed with a stainless steel power wire brush.
 - 2. Field joints shall be made with a splice-lock connector which shall provide a firm, permanent connection. The connector shall mechanically draw the railing sections together to form tight, hairline joint.
- C. Guarding of Openings.

Metal Railings

1. Openings in railing shall be guarded by self closing gates. Self closing gates shall be fabricated of the same materials with the same finish as the guardrailing. The closure device shall be Manufacturer's standard.

D. Sleeves.

1. Sleeves for fixed handrail posts shall be fabricated from Schedule 40 PVC pipe or from stainless steel pipe. Sleeves shall provide at least 1/4 inch clearance all around each post and shall be 5 inches long unless otherwise indicated on the Drawings.
2. Sleeves for removable posts shall have an outer and inner sleeve. The outer sleeve shall be fabricated from stainless steel pipe. The inner sleeve shall be Schedule 40 PVC pipe.

2.6 COATING.

A. Aluminum.

1. All surfaces of aluminum which will be in contact with concrete shall be coated with bituminous paint. All surfaces of aluminum which will be in contact with dissimilar metals shall have a 15 mil thick sheet of oriented polyester film placed between the two surfaces.
2. All aluminum railings shall be provided with a clear anodic finish.

PART 3 - EXECUTION

3.1 INSTALLATION.

- A. When railings are assembled, all posts shall be plumb and longitudinal members shall be parallel with each other and with the floor surface or slope of stairs. In any section or run of railing, the center lines of all members shall be in true alignment, positioned in the same vertical plane. All posts in fixed handrail sections shall be rigidly attached to the supporting structure. After installation, railings shall be checked for final alignment, using a tightly drawn wire for reference. The maximum misalignment tolerance for railings shall be 1/8 inch in 12 ft. Bent, deformed, or otherwise damaged installations shall be replaced.

B. Attachment to Concrete.

1. Posts shall be attached to concrete structures as indicated on the Drawings. Base flanges and side-mount brackets shall be installed with minimal disturbance to the reinforcing steel. Bolts shall be stainless steel adhesive anchors as specified in the Post Installed Anchors section.
2. Sleeves shall be rigidly supported in accurate alignment in the forms and shall be positioned vertically so that the top of each sleeve is approximately 1/2 inch below the finished concrete surface. The position of all sleeves shall be carefully

Metal Railings

measured before railings are fabricated. When the railing is set, the posts shall be wedged in accurate alignment, and the annular space between the posts and sleeves shall be filled with post setting cement to the top of the steel sleeve. Filling of the remaining space with sealant, as indicated on the Drawings, is covered in the Caulking section.

C. Attachment to Aluminum.

1. Attachments to aluminum shapes shall be made with flanges or with other special attachments or anchorages as detailed on the Drawings.

D. Removable Attachments.

1. For removable guardrail sections in embedded sleeves, inner sleeves shall be set in outer sleeves in the same manner as specified herein for the setting of fixed posts. Particular care shall be taken to ensure that the inner sleeves are accurately spaced and plumbed, so that the guardrail sections, when set in position, will stand in proper alignment and will be removable without binding.
2. Removable guardrail sections with base flanges or side mount brackets shall be secured in the bases with removable screws.

E. Wall Mounted Handrailing.

1. Suitable wall brackets shall be provided where shown or required. Wall brackets shall be securely anchored to walls with stainless steel adhesive anchors as specified in the Post Installed Anchors section. Expansion anchors shall not be used unless specifically indicated on the Drawings.

F. Connections.

1. Welding connectors and splice locks shall be installed in accordance with the manufacturer's recommendations. Other methods of making connections and changes in alignment will be considered, provided complete information covering the proposed method is submitted to Engineer for review.

End of Section

Metal Gratings

Section 05 53 00 – METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. If differing requirements are identified elsewhere (in these Specifications or on drawings or separate instructions), the more stringent requirement shall be met.

1.2 SUMMARY

A. Section Includes:

1. Formed floor, mezzanine, and stair tread gratings.
2. Flat surface floor and stair tread plating/planking.
3. Perimeter closure.
4. The Contractor shall furnish, fabricate (where necessary), and install all aluminum grating and plating with all appurtenances, accessories and incidentals necessary to produce a complete, operable, and serviceable installation as shown on the Contract Drawings.

B. Related Requirements:

1. Section 05 50 00 Metal Fabrications: Miscellaneous metal components as required by this Section.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
3. ASTM B211M – Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
4. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

Metal Gratings

5. ASTM B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 6. ASTM E84 Surface Burning Characteristics of Building Materials.
- B. American Welding Society:
1. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 2. AWS D1.1 – Structural Welding Code – Steel
 3. AWS D1.2 – Structural Welding Code – Aluminum.
- C. Green Seal:
1. GC-03 – Anti-Corrosive Paints.
- D. National Association of Architectural Metal Manufacturers:
1. NAAMM AMP 501 – Finishes for Aluminum.

1.4 COORDINATION

- A. Coordinate Work of this Section with placement of frames, tolerances for placed frames, and openings.

1.5 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Product Data: The Contractor shall submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations as required if manufacturer's standard literature is unavailable or data does not conform to project requirements.
- C. Shop Drawings:
1. The Contractor shall furnish shop drawings of all fabricated gratings and plating and accessories in accordance with the provisions of this Section.
 2. The Contractor shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

Metal Gratings

- D. Samples: The Contractor may be requested to submit sample pieces of each item specified herein for acceptance by the Engineer as to style, quality, and color. Sample pieces shall be manufactured by the method to be used in the Work.
- E. Manufacturer's Certificate: Certify that the products meet or exceed the specified requirements.
- F. Welders' Certificates: Certify welders and welding procedures employed on the Work, verifying AWS qualification within previous 12 months.
- G. Manufacturer's Instructions: Submit special requirements of openings and perimeter framing.

1.6 QUALITY ASSURANCE

- A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years' experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.
- B. Comply with applicable provisions and recommendations of the following: NAAMM Metal Bar Grating Manual designated ANSI/NAAMM MBG 531 (Aluminum and Light Duty Steel and Stainless Steel Grating) and MBG 532 (Heavy Duty Steel Grating).
- C. ASTM B221, Aluminum Alloy, Extruded Bars, Rods, Wire, Shapes and Tubing.
- D. Take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.
- E. Manufacturer shall offer a 1-year limited warranty on all aluminum products against defects in materials and workmanship.

1.7 QUALIFICATIONS

- A. Welders and Welding Procedures: AWS D.1- or AWS D1.2- qualified (as applicable) within previous 12 months for employed weld types.

1.8 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

Metal Gratings

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Design Live (Pedestrian) Load: Uniform load of 100 lb./sq. ft. minimum or a concentrated load of force 300 lb.
- B. Maximum Allowable Deflection under Live Load is not to exceed 0.375 inch or L/D = 180, whichever is less.
- C. Maximum Spacing between Bars: 3/8 inch.

2.2 GRATINGS AND FLOOR PLATING (PLANKING)

- A. Manufacturers:
 - 1. Aluminum Grating and Plating
 - a. Aluminum Plank Grating with Traction Tread
McNichols
Tampa, Florida
 - b. Or approved equal.

2.3 MATERIALS

- A. Aluminum shapes and bearing bars: ASTM B221, Alloy 6063T5/T52 extruded aluminum alloy, of shapes indicated.
- B. Crossbars: Type 6063-T5/T52 aluminum rectangular bars, slotted and mechanically locked in dovetail fashion at right angles to, and in the same plane as, the top surface of bearing bars at a maximum of 2 inches on center.
- C. Welding Materials: AWS D1.1 or AWS D1.2, type as required for materials being welded.
- D. Surface: Slip-Resistant

2.4 FABRICATION

- A. Measurements: Grating and Plating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

Metal Gratings

- B. Layout: Each grating or plating section shall be readily removable, except where indicated on Drawings. Manufacturer to provide openings or finger (or “pick”) holes at ends of solid plating that is removable. Grating openings that fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
- C. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

2.5 GRATING SUPPORT

- A. If not otherwise denoted on drawings, gratings to be supported by embedded 304 SS angle.
- B. If allowed by Engineer, angle supports may be used and will be 304 SS and placed as necessary to support the grating to the load/deflection denoted in Section 2.1 above.

2.6 FINISHES

- A. The gratings shall be provided with a mill finish.

2.7 ACCESSORIES

- A. Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 73 19 Equipment Installation: Requirements for installation examination.
- B. Verify that opening sizes and dimensional tolerances are acceptable.
- C. Verify that supports are correctly positioned.

3.2 PRODUCT DELIVERY AND STORAGE

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities

Metal Gratings

between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

3.3 INSTALLATION

- A. Place frames in correct position, plumb and level.
- B. Contractor shall install gratings/platings in accordance with manufacturer's assembly drawings.
- C. Set perimeter closure flush with top of grating and surrounding construction.
- D. Cutting, Fitting and Placement:
 - 1. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
 - 2. Follow manufacturer's instructions when cutting or drilling aluminum products. Seal cut or drilled surfaces in accordance with manufacturer's instructions.
 - 3. Wherever grating is pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as the bearing bars.
 - 4. Cutouts for circular obstructions are to be at least 2 inches larger in diameter than the obstruction.
 - 5. Utilize standard panel widths wherever possible.
- E. Grating/Plating Attachment:
 - 1. Secure to prevent movement.
 - 2. Use approved attachment system and fasteners to secure to supporting members.
- F. Protection of Aluminum from Dissimilar Materials:
 - 1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or other approved insulating material.
 - 2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry, or lime mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or other approved insulating material.

3.4 TOLERANCES

- A. Section 01 45 00 Quality Control: Requirements for tolerances.
- B. Conform to NAAMM MBG 531.

Metal Gratings

- C. Maximum Space Between Adjacent Sections: 1/4 inch.
- D. Maximum Variation from Top Surface Plane of Adjacent Sections: 1/8 inch.

3.5 CLEANING

- A. Section 01 73 19 Equipment Installation and Section 01 77 00 Closeout Procedures: Requirements for cleaning.

End of Section

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Rough Carpentry

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 – GENERAL

- 1-1. SCOPE: This section covers miscellaneous items indicated on the Drawings to be of wood construction.
- A. Rough Carpentry shall include the following:
1. Rooftop equipment bases and support curbs.
 2. Wood blocking and nailers.
 3. Plywood backing panels.
- 1-2. SUBMITTALS: Submittals will not be required for items covered in this section.
- 1-3. PROTECTION & STORAGE: Lumber shall be protected and kept under cover, both in transit and at jobsite. Lumber shall be carefully stacked on suitable supports in a manner which will ensure proper ventilation and drainage.
- A. All lumber shall be delivered to the jobsite bearing grade stamps of the Northeastern Lumber Manufacturers' Association (NeLMA) or Southern Pine Inspection Bureau (SPIB). All lumber shall be segregated by grades. Extreme care shall be exercised in unloading the lumber to prevent damage, splitting, or breaking of materials.
- B. All plywood shall be identified according to species, grade, and glue type by stamp of the American Plywood Association (APA) or equal.

PART 2- PRODUCTS

- 2-1. ROUGH CARPENTRY: Lumber shall conform to American Softwood Lumber Standard PS 20 and applicable rules of grading agencies shall be indicated. Comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review if no grading agency is indicated. Lumber shall be graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
- A. All wood framing, blocking, and nailers shall be installed as indicated on Drawings or as required to complete a finished building.
- B. All rough carpentry shall be true, tight, and secure, with all members assembled in accordance with Drawings and to all pertinent codes and regulations.
- C. Each piece of lumber to be hand selected for uniformity, appearance, and free from obvious defects that will interfere with placement of fasteners. All defective pieces deemed useable shall be discarded. Any piece of lumber that is too small to be used during construction shall be discarded.
- D. Engineer has liberty to reject all lumber, whether installed or not, that has excessive splits, warp, twist, bow, crook, mildew, or fungus, as well as for improper cutting and fitting.
- E. All Each piece of lumber to be marked with grade stamp of grading agency in factory.

Rough Carpentry

- F. Dress lumber, S4S, unless otherwise indicated.
 - G. Maximum Moisture Content of Lumber: 19 percent or less
- 2-1. PRESSURE TREATED LUMBER: Southern yellow pine, Structural no. 1, above ground use; exterior use, AWPA-UC3 classification.
- A. Preservative Chemicals: ACQ (Alkaline Copper Quaternary) Type B and D or CBA (Copper Azole). CCA (Chromated Copper Arsenate) will not be acceptable.
 - B. Treated lumber to be kiln-dry with a maximum moisture content of 19 percent or less. Lumber warped or that does not comply with requirements for untreated materials are not acceptable.
 - C. Lumber to be marked indicating treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - D. Application: Treat wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
- 2-2. FIRE RETARDANT TREATED MATERIALS: Where lumber is required to be fire retardant treated, materials are to comply with requirement of this section, that are approved by authorities having jurisdiction, and with fire test response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- A. Fire Retardant Treated Lumber and Plywood by Pressure Process: ASTM E84; flame spread index of 25 or less.
 - 1. Exterior Type: Treated materials for exterior application shall comply with testing above and be subject to accelerated weathering per ASTM D2898.
 - 2. Interior Type A: Treated materials for interior application shall have a moisture content of 28 percent or less per ASTM D3201 at 92 percent relative humidity.
 - B. Kiln Dry Lumber: Maximum moisture content of 15 percent after treatment.
 - C. Identify fire retardant treated wood with appropriate classification marking of qualified testing agency.
 - D. Application: Treat all rough carpentry unless otherwise indicated.
- 2-3. DIMENSIONAL LUMBER FRAMING: Not used.
- 2-4. PLYWOOD PANELS:
- A. A. Fire Retardant Treated: FR-S rated, APA rated sheathing, Exterior, A-C], Exposure 2, span rating 48/24, thickness 3/4 inch,
- 2-5. FASTENERS: Properly size and select fastener type required to comply with requirements as specified.

Rough Carpentry

A. Hardware: Stainless steel, Type 18-8, 304, or 316

2-6. MISCELLANEOUS MATERIALS:

- A. Sill Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, [butyl rubber] [or] [rubberized asphalt] compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6mm)
- C. Adhesives for Gluing to Concrete or Masonry: Products complying with ASTM D3498 and approved for use by adhesive manufacturer.

PART 3 – EXECUTION

3-1. INSTALLATION:

- A. Framing Standards: Not used.
- B. Rough Carpentry: Rough carpentry work shall be set to required levels and lines, with members plumb, true to line, and fitted. Rough carpentry to fit accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction. Framing members shall not be bored or cut for pipes, ducts, conduits, or for any other reasons except where accepted by Engineer.
 - 1. Nailers: Nailers shall be provided where indicated on Drawings. Nailers shall be continuous and shall be installed level and straight. Each nailer section shall be secured by at least two (2) anchor bolts.
- C. Pressure Treated Lumber: Comply with AWWA M4 for applying field treatment to cut surfaces of pressure treated lumber. Where pressure treated wood is installed adjacent to metal decking, place a continuous flexible flashing separator between pressure treated wood and metal decking.
- D. Fasteners: Rough carpentry is to be securely attached to substrate with anchors and fastenings as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in 2020 Florida Building Code, Building, 7th Edition.
 - 2. ICC-ES evaluation report for fastener.

3-2. PROTECTION:

- A. Protect rough carpentry from weather. Despite protection if rough carpentry gets wet or wet enough that moisture content exceeds that specified, apply an EPA-registered borate treatment. Borate solution applied shall comply with EPA-registered label.

End of Section

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Dampproofing

SECTION 07 11 00 - DAMPPROOFING

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers furnishing and installation of dampproofing for concrete.
- B. Dampproofing of concrete surfaces exposed to water in potable water treatment, distribution, or pumping facilities, shall be with NSF certified epoxy enamel, and shall be in accordance with the Protective Coatings section. Waterproofing is covered in the Elastomeric High-Solids Urethane Lining Systems section.

1.2 SUBMITTALS

- A. Drawings and Data
 - 1. Complete specifications and data covering the dampproofing materials furnished under this section shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable materials to be used shall be as follows:
 - 1. Coal Tar Epoxy: Ameron “Amercoat 78HB Coal Tar Epoxy, Carboline “Bitumastic 300 M,” Tnemec “46H-413 Hi-Build Tneme-Tar,” or Sherwin-Williams “Hi-Mil Sher-Tar Epoxy”
 - 2. Emulsified Asphalt: Henry “HE 107-Ashalt Emulson”
 - 3. Epoxy Enamel: As specified in the Protective Coating Section.
 - 4. Membrane: Grace “Bituthene 3000 and Bituthene Low Temperature”
- B. Emulsified asphalt shall be solvent free and made from asphalt emulsified with bentonite clay and water.
- C. Membrane shall be a self-adhesive rubberized asphalt/polyethylene waterproofing material with a minimum thickness of 1/16 inch.
- D. For surfaces which will be in contact with potable or raw water in water treatment plants, distribution, or pumping facilities see Section 09940 Protective Coatings.

Dampproofing

- E. Waterproofing is recommended for walls in contact with liquid where the opposite face is above grade or exposed in an interior room. See Section 09886 Elastomeric High-Solids Urethane Lining Systems for waterproofing.

2.2 SURFACES TO BE DAMPPROOFED

- A. Exterior wall surfaces which are poured against sheeting or undisturbed earth need not be dampproofed. The following concrete surfaces that are not in contact with treated or potable water shall be dampproofed:
 - 1. All exterior concrete wall surfaces forming a part of an interior room or dry pit which will be in contact with earth backfill below finished grade and above the top of the footings or bottom slabs.
 - 2. All exterior wall surfaces of cast-in-place and precast concrete electrical manholes and handholes below finished grade and above the top of the footings or bottom slabs.
 - 3. All walls in contact with liquid where the opposite face is above grade or exposed in an interior room, except when waterproofing is specified.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. When dampproofing is applied, concrete surfaces shall be clean and dry. Any repairs to existing concrete shall be made as part of the surface preparation in accordance with the Concrete Crack Repair section. Concrete repair methods shall be acceptable to the Engineer. Except where membrane is applied, new concrete shall cure at least 28 days before dampproofing material is applied. Concrete shall be allowed to cure in accordance with the membrane manufacturer's recommendation before membrane dampproofing is applied. Concrete shall be prepared to receive the dampproofing material as recommended by materials manufacturer.
- B. All dirt, dust, sand, grit, mud, oil, grease, and other foreign matter shall be removed in accordance with ASTM D4258 and the surface abraded when recommended by the manufacturer of the dampproofing material. Abrading shall be done in accordance with ASTM D4259. Prior to application of the coating, the surfaces shall be thoroughly washed, or cleaned by air blasting, to remove all dust and residue.

3.2 APPLICATION

- A. Dampproofing materials shall not be thinned unless recommended by the manufacturer. Dampproofing using coal tar epoxy shall be applied in at least two coats, with a total dry film thickness of at least 20 mils.
- B. Surfaces not intended to be dampproofed shall be protected from contamination, discoloration, or other damage. Such surfaces shall be masked as necessary to protect uncoated areas and to confine the dampproofing to the intended limits.

Dampproofing

- C. Surfaces shall be dry and at recommended temperature when dampproofing is applied. Unless properly protected, coatings shall not be applied in wet, damp, or foggy weather or when windblown dust, dirt, or debris, or insects would collect on the coating. Dampproofing, other than low temperature membrane dampproofing, shall not be applied when the temperature of the air or the surface is below 50° F, unless approved by manufacturer. Low temperature membrane dampproofing may be applied at air and surface temperatures as low as 25° F if approved by manufacturer and acceptable to the Engineer.
- D. Dampproofing shall be applied by brush, high pile rollers, or spray equipment complying with the manufacturer's recommendations. If blistering occurs, all blisters larger than 1/4 inch in diameter shall be broken before the subsequent coat is applied.
- E. Emulsified asphalt shall be installed in accordance with manufacturer's recommendations and at the maximum coverage rate recommended by manufacturer that is acceptable to Engineer.
- F. Membrane shall be installed in accordance with manufacturer's recommendations including the recommended primer.

End of Section

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Thermal Insulation

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1-1. SCOPE.

- A. This section covers thermal insulation for the Operations Building's interior walls and associated items not covered in other sections.
- B. Mechanical ductwork insulation is specified in the Mechanical Insulation Section.

1-2. GENERAL.

- A. Thermal insulation shall be furnished and installed as specified herein and as indicated on the Drawings.

1-3. SUBMITTALS.

- A. Complete specifications covering the materials furnished shall be submitted in accordance with General Conditions, Section F-29 Equipment and Material Section.
- B. Submit product data and a sample of each type of thermal insulation. Such samples will be held to be representative of the properties and characteristics of the insulation in the as-installed condition.

1-4. STORAGE AND HANDLING.

- A. All materials shall be delivered in the original unopened packages bearing the name of the manufacturer and the brand. Insulation shall be stored under cover in a dry place, and shall be protected from the weather at all times. Good fire safety practices shall be observed at all times during storage and installation.

PART 2 – PRODUCTS

2-1. MATERIALS. Materials to be used shall conform to the following:

- A. Batt Insulation: ASTM C66, Type 1 and ASTM E136, mineral or glass fiber (unfaced) 6 inch thicknesses, Owens-Corning, CertainTeed or Johns Manville.
- B. Rigid Insulation: ASTM C518 Extruded Polystyrene (XPS) insulation. 1-1/2 inch thicknesses. (R-7.5). Owens-Corning, "FOAMULAR 250" or approved equal.

Thermal Insulation

PART 3 – EXECUTION

3-1. INSTALLATION.

- A. Metal Stud Walls. Batt type insulation shall be forced into the space between the metal studs for a friction-fit installation.
- B. Metal Furring. Rigid insulation shall fit between Z-furring.
- C. Suspended Ceilings. Batt type insulation shall be laid directly above the ceiling tiles with no gap between batts.

3-2. LOCATION FOR INSTALLATION.

- A. Batt Insulation. Sound attenuating batt insulation shall be installed in interior metal stud partition walls and above suspended ceiling panels in the following locations; offices, restrooms, lockers rooms, conference room, reception, and break room. Insulation thickness shall be sized appropriately for the wall construction thickness the insulation is located within.
- B. Rigid Insulation. Thermal ridged insulation shall be installed between metal Z-furring in the following locations; inside face of exterior masonry walls as indicated on the drawings.

End of Section

SECTION 07 27 20 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1-1. SCOPE.

- A. This section covers fluid-applied membrane air barrier, vapor permeable.

1-2. GENERAL.

- A. Fluid-applied membrane air barriers shall be furnished and installed as specified herein and as indicated on the Drawings. Membranes shall be applied to the back-up material for the masonry veneers were indicated on the Drawings.

1-3. SUBMITTALS.

A. General Submittals:

1. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
3. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction. Include details of interfaces with other materials that form part of air barrier. Include details of mockup panels.
4. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
5. Qualification Data: For Applicator.

1.2 1-4. QUALITY ASSURANCE.

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is an Air Barrier Association of America (ABAA) licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program.
- B. Mockups: See Building Masonry section for the masonry sample panels. Before beginning installation of air barrier, build mockups of exterior wall assemblies shown on Drawings, incorporating backup wall construction, external cladding, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.

Fluid-Applied Membrane Air Barrier

2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 3. If Engineer determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 4. Approved mockups may not become part of the completed Work.
- C. Pre-installation Conference: Conduct conference at Project site.
1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, masonry, sealants, windows, glazed curtain walls, and door frames.
 2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.
- 1.3 1-5. DELIVERY, STORAGE, AND HANDLING.
- A. See the Product Delivery Requirements section and the Product Storage and Handling section for additional requirements.
 - B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
 - C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
 - D. Store rolls according to manufacturer's written instructions.
 - E. Protect stored materials from direct sunlight.
- 1.4 1-6. PROJECT CONDITIONS.
- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials to be used shall conform to the following:

- B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

Fluid-Applied Membrane Air Barrier

- a. Synthetic Polymer Membrane:
 1. BASF Corporation – Wall Systems; Enershield-HP
 2. Grace, W. R. & Co.; Perm-A-Barrier VP Liquid.
 3. Henry Company; Air-Bloc 31 or 33 (UV enhanced protection).
2. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Assembly Air Permeance; Not to exceed 0.04 cfm x sq. ft. (0.2 L/s x sq m); ASTM E 2357.
 - c. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.

1.5 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
- C. Counterflashing Strip: Modified bituminous, 40 mil thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an eight mil thick, crosslaminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor-retarding, 30 to 40 mil thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.
- E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
- F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Sprayed Polyurethane Foam Sealant: 1 or 2 component, foamed in place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- I. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50 to 65 mil thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with aluminum termination bars and stainless-steel fasteners .
- J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with the Caulking specification section.

Fluid-Applied Membrane Air Barrier

- K. All materials shall be delivered in the original unopened packages bearing the name of the manufacturer and the brand. Materials shall be stored under cover in a dry place, and shall be protected from the weather at all times. Good fire safety practices shall be observed at all times during the storage and installation.

PART 3 - EXECUTION

1.6 3-1. EXAMINATION.

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected.

1.7 SURFACE PREPARATION.

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

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1.8 3-3. JOINT TREATMENT.

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of three inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

1.9 3-4. TRANSITION STRIP INSTALLATION.

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure compatibility and continuity of air barrier with roofing membrane.
 - 2. Install butyl strip on roofing membrane or base flashing so that a minimum of three inches of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow drying. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply elastomeric flashing sheet so that a minimum of three inches of coverage is achieved over both substrates. Maintain three inches of full contact over firm bearing to perimeter frames with not less than one inch of full contact. Follow air barrier manufacturer's written instructions for optional wall opening treatment.
 - 1. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at six inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

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- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

1.10 AIR BARRIER MEMBRANE INSTALLATION.

- A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply primer to substrates at required rate and allow drying. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
- D. Apply a continuous unbroken air barrier to substrates according to air barrier manufacturer's written instructions. Apply membrane in full contact around protrusions such as masonry ties.
- E. Apply strip and transition strip over cured air membrane overlapping three inches onto each surface according to air barrier manufacturer's written instructions.
- F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components with no additional cost to the owner.

1.11 3-6. FIELD QUALITY CONTROL.

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.

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4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.
- D. Remove and replace deficient air barrier components and retest as specified above.

1.12 3-7. CLEANING AND PROTECTION.

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 180 days or manufacturer's recommendation.
 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

End of Section

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Metal Wall Panels

SECTION 07 41 20 - METAL WALL PANELS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and erection of two types of metal wall panels, including trim, copings, flashings, clips, fasteners, sealants, and appurtenances, as indicated on the Drawings and as specified herein.

1-2. GENERAL. The materials to be furnished and installed under this section include, but are not limited to, the following:

- Factory-formed, insulated and field-assembled wall panels.
- Subgirts, where required.
- Flashings, trim, copings, and closures.
- Clips, spacers, and shims.
- Caulking and sealing materials.
- Fasteners.

1-3. SUBMITTALS. Submit product data that includes material descriptions, dimensional characteristics of individual components and profiles and finishes of panels and components. Before fabrication, detailed fabrication and erection drawings shall be submitted in accordance with the Submittals section. Submittals shall include jointing, trim, and flashing and coping details, including termination and penetrations.

1-4. HANDLING AND STORAGE. The wall panel materials shall be handled in a manner, which will prevent bending, dents, scratches, or damage of any kind. Damaged units and accessories will be rejected and shall be replaced by and at the expense of the Contractor promptly after rejection. Materials shall be stored under cover at all times.

1-5. FINISH. Wall panels, trim, seam corners, flashings, copings and all exposed appurtenances shall have finish coatings as specified in the Materials section of this specification.

1-5.01. Color Selection. The colors shall be selected by the Engineer to match the existing Reverse Osmosis Building from the manufacturer's full range of standard and custom colors. Samples shall be submitted for color selection.

1-6. WARRANTY. The manufacturer of the metal wall systems shall furnish to the Owner a warranty covering materials for a period of 2 years and finish for a period of 20 years from the date of acceptance. Wall panels shall be designed for 20 psf wind pressure and a maximum deflection of L/180. Span lengths between supports shall be as indicated on the Drawings. This warranty shall also cover any panels that are reused from the existing building.

The applicator of the metal systems shall provide a warranty covering installation and workmanship for a period of 2 years from the date of acceptance, including any reinstalled existing panels.

PART 2 - PRODUCTS

Metal Wall Panels

2-1. MATERIALS. Materials shall conform to the following:

Field Assembled Wall System

Concealed Fastener (Lap Seam)
Metal Wall Panel

Smooth surface coil-coated, ASTM B209, 0.040 inch nominal thickness, 7/8 inch deep by 16 inches wide, Centria “CS-660” or approved equal.

Subgirts (as required)

Hat shaped steel furring channel as shown on the drawings, 18 gage, G90 galvanized; Centria "Hat shaped subgirt" or approved equal.

Flashings, Trim and Coping

Periphery trim shall have concealed fasteners wherever possible. Extruded aluminum sections shall be supplied with finish matching panels. Extruded aluminum profiles as indicated on the drawings shall be formed with 6063-T5 aluminum with the exposed surface finished to match wall panels. All joints in extrusions shall have internal lapstrips faced on the outside with bond breaker tape and face sealed with silicone sealant. Extrusions shall be designed to eliminate field applied sealants. Sheet metal trim shall be material with finish to match the panels. Gauges shall be adequate to insure flatness. Perimeter sill trim shall be designed to not hold water and shall have weep holes where required.

Clips, Spacers, and Shims

Manufacturer’s standard, noncorroding.

Fasteners

Manufacturer’s standard self-tapping screws or bolts with separate cupped washers and bonded neoprene gaskets; Alloy 305 stainless steel for all exterior, and for interior in contact with aluminum; cadmium plated steel in contact with interior steel, concealed where possible.

Caulking Tape

Reinforced polyisobutylene, Interchemical “Prestite 162”, Pecora “B-44 Extrude-Seal”, or approved equal.

Caulking Compound

Polybutene, Presstite “412.9”, Tremco “RP545 Seamsealer”, or approved equal.

Metal Wall Panels

Finish

Concealed Fastener (Lap Seam)
Metal Wall Panel

Two-Coat Fluoropolymer: AAMA 2605.
Two-cat system consisting of a corrosion
inhibitive primer on both sides with a
Fluoropolymer finish containing not less
than 70 percent Kynar 500/Hylar 5000
polyvinylidene fluoride (PVDF) resin by
weight in color coat. Color shall be chosen
from manufacturer's standard colors,
minimum 18 colors.

Metal panel returns and mitered panel corners shall match the conditions of the existing building at similar conditions.

PART 3 - EXECUTION

3-1. INSPECTION. The applicator shall examine the surfaces on which the work is to be applied. The applicator shall notify the Engineer, in writing, if the surfaces are not suitable to receive the metal wall panels. Applicator shall obtain and verify all field measurements prior to fabrication of the wall panels.

3-2. FABRICATION. Panels (Lap Seam) shall be field assembled as indicated on the Drawings and specified herein.

Wall panels, flashings, trim, and accessories shall be fabricated in accordance with the details on the Drawings, to tolerances, which will ensure proper fit, appearance, and weathertightness when erected.

The wall panel system shall be fabricated so that no fasteners are exposed after erection, except where exposed fasteners are incorporated in the design or are required for securing flashing and trim. The field assembled system shall consist of liner panels, insulation, and subgirts as indicated.

Flashings shall include all materials referred to on the Drawings as flashings, trim, or closures.

3-3. INSTALLATION. The Contractor shall check the alignment of the girts and other steel supporting the wall panel materials. The Contractor shall notify the Engineer if any of the supporting structural steel is not aligned to the tolerances established by the AISC.

Materials shall be installed by experienced mechanics who are directly employed by the wall panel manufacturer or by an erector currently franchised by the panel manufacturer and who has experience in installing projects of similar or greater complexity.

Both metal wall panel systems shall be installed complete with all flashings, copings, appurtenances and accessories. Joints and seams shall be maintained in correct horizontal and vertical alignment.

Metal Wall Panels

Adequate provisions shall be made for framing around all openings indicated on the Drawings with finished flashings matching the wall panels.

All joints shall be securely sealed and drawn tight during erection as indicated on the Drawings or as directed by the panel manufacturer, to provide permanent, positive and complete protection against infiltration of air or moisture.

All trim, extrusions, closure panels, copings and flashings shall be installed to provide watertight joints. All penetrations shall be coordinated with the work of other trades. Any damaged materials shall be replaced; only minor scratches and abrasions may be touched up.

3-4. CLEANING. After installation is complete, all exposed surfaces of the wall panel systems, including flashings, copings and accessories, shall be cleaned of all dust, dirt, grease, and other foreign material to the satisfaction of the Engineer.

End of Section

Thermoplastic-Polyolefin (TPO) Roofing

SECTION 07 5423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 – GENERAL

1.1. SCOPE

- A. This section covers furnishing and installation of a fully adhered thermoplastic polyolefin (TPO) single-ply membrane roof system with vapor retarder, adhesives, fasteners, flashings, substrate board, roof insulation, coverboard, and accessories.

1.2. GENERAL

- A. Except as otherwise indicated on Drawings, all new roof decks shall be covered with insulation, fully adhered TPO single-ply membrane roofing system as indicated. The finished roof shall be watertight under all conditions of weather and service except physical damage due to unforeseen causes.
 - 1. The roof system shall meet UL rating Class A and shall be designed to withstand 90 mph peak wind gusts for a minimum three seconds without damage. Unless indicated otherwise, a complete total system guarantee covering all elements of the roofing system shall be furnished with this work. A warranty or guarantee which covers only the membrane will not be acceptable.

1.3. SUBMITTALS

- A. Complete specifications and data covering the roofing systems and materials furnished under this section shall be submitted in accordance with the Submittals Procedures section.
 - 1. Product Data: Include copy of FM Approvals' RoofNav listing.
 - 2. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 - a. Layout and thickness of insulation.
 - b. Base flashings and membrane termination details.
 - c. Flashing details at penetrations.
 - d. Tapered insulation layout, thickness, crickets, and slope.
 - e. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacing, and patterns for mechanically fastened roofing system.
 - f. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 - g. Tie-in with adjoining air barrier.
 - 3. Samples: Samples of the roofing membrane, insulation, and fasteners shall be submitted as followed:
 - 4. Wind Uplift Resistance Submittal: Data shall be submitted showing compliance with UL requirements for roofing system Class rating, and the Factory Mutual wind uplift performance requirements.

Thermoplastic-Polyolefin (TPO) Roofing

5. Performance Requirement Certificates: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in “Performance Requirements” Article.
 - a. Submit evidence of compliance with performance requirements.
6. Special Warranty Certificate: Signed by roof manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
7. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements
8. Sample Warranties

1.4. QUALITY ASSURANCE

- A. Unless indicated otherwise on Drawings, work under this section shall be done by a qualified roofing subcontractor who has been in business for at least 5 years. Subcontractor shall be an installer who has meets highest level of installers for that manufacturer’s roofing system. Subcontractor shall submit a qualification letter from roofing manufacturer stating that roofing contractor is an applicator and is able to offer 30 year Total System NDL Guarantee required for this specific project. This qualification letter must accompany bid to General Contractor.
 1. The work shall be inspected by a representative of membrane manufacturer to verify that materials and methods of application are in accordance with the recommendations of the manufacturer and with these specifications.
 2. Subcontractor shall coordinate and attend a pre-construction roof meeting with General Contractor and the roofing manufacturer’s technical representative prior to roof installation. Subcontractor shall submit a Notice of Award (NOA) and project information to roofing manufacturer prior to project start.

1.5. WARRANTY

- A. Unless otherwise indicated, the manufacturer of roofing membrane shall furnish to Owner, through the roofing subcontractor, a non-prorated, 30 year No Dollar Limit (NDL) Guarantee, total roof system including membrane, insulation, fasteners, vapor retarder, and flashings for a period of 30 years from date of Substantial Completion.
 1. The guarantee shall provide repair of the total roofing system including repairs to membrane, flashing, counterflashings, insulation, vapor barrier and cover boards, if required, fasteners, adhesives and sealants resulting from all leaks in membrane and base flashings that may occur due to defective materials, improper workmanship, and normal weather conditions. Unless otherwise indicated, warranty shall include wind uplift protection for peak gusts up to 90 mph. The guarantee shall also provide limited coverage for hail damage.
 2. In addition, manufacturer shall also provide a separate materials warranty covering membrane for not less than 30 years against premature deterioration because of weather.

Thermoplastic-Polyolefin (TPO) Roofing

PART 2 - PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
- B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the “Resistance to Foot Traffic Test” in FM Approvals 4470.
- C. Wind Uplift Resistance: Design Roofing following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897: Refer to Drawings for load designs.
- D. FM Approvals’ RoofNav Listings: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 450 or FM Approvals 4470 as part of a roofing system and shall be listed in FM Approvals’ RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: Class 1A-90
 - 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH
- E. ENERGY STAR Listing: Roofing system shall be listed on the DOE’s ENERGY STAR “Roof Products Qualified Product List” for low-slope roof products.
- F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
 - 1. Exterior Fire-Test Exposure: ASTM E108 or UL 790 Class A for application and roof slope indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 2. Fire-Resistance Rating: Comply with fire-resistance rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2. THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim-reinforced, fleece backed TPO Sheet.
 - 1. Thickness: 80 mils
 - 2. Exposed Face Color: White

Thermoplastic-Polyolefin (TPO) Roofing

- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carlisle SynTec, Inc.
 - b. Elevate Roofing, Wall, and Lining Systems
 - c. GAF
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Or approved equal.

2.3. AUXILIARY ROOFING MATERIALS:

- A. Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing 55 mils thick minimum, and same color and TPO sheet.
 - 3. Prefabricated Pipe Flashing: As recommended by roof membrane manufacturer.
 - 4. Bonding Adhesive: Manufacturer's standard.
 - 5. Slip Sheet: Manufacturer's standard of thickness required for application.
 - 6. Metal Termination Bars: Not used.
 - 7. Fasteners: Not used.
 - 8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashing, preformed inside and outside corner sheet flashings, T-joint covers, lab sealants, termination reglets and other accessories.

2.4. SUBSTRATE BOARD

- A. ASTM C1177/C177M, glass-mat, water resistant, Type X 5/8 inch gypsum board.
 - 1. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. CertainTeed Corporation
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company
 - d. USG Corporation.
 - e. Or approved equal

2.5. VAPOR RETARDER

Thermoplastic-Polyolefin (TPO) Roofing

- A. ASTM D2178/D2178M, Glass Fiber Felts, Type IV; asphalt impregnated.

2.6. ROOF INSULATION:

- A. Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies. Roof insulation shall have an average thermal resistance R-value of R-30 at an R-value of R5.0 per inch. Minimum 2 inches of insulation is required at roof drain and drainage scupper low points unless otherwise indicated on the Drawings.
- B. Extruded-Polystyrene Board Insulation (XPS): ASTM C578, Type IV, 1.45 lb./cu. ft. (23 kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength square edged.
 - 1. Thickness: Minimum base layer thickness 1-1/2 inches (38 mm) Upper Layer thickness as required to meet minimum energy code requirements or R-value as stated herein.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Dow Chemical Company (The).
 - b. Owens Corning.
 - c. Or approved equal.
- C. Polyisocyanurate Board Insulation (ISO): Not used.
- D. Tapered Insulation: Provide factory-tapered insulation boards that match roof insulation. Roof slope to be 1/4 inch per foot unless otherwise indicated on Drawings.
 - 1. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.7. INSULATION ACCESSORIES:

- A. Roof insulation accessories recommend by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provision in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- D. Cover Board: ASTM C1289 Type II Class 4, Grade 1, 1/2 inch thick HD Plus polyisocyanurate, with a minimum compressive strength of 109 psi.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Thermoplastic-Polyolefin (TPO) Roofing

- a. Elevate Roofing, Wall, and Lining Systems.
 - b. GAF.
 - c. Georgia Pacific.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Or approved equal.
- E. Protection Mat: Woven or non-woven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

2.8. WALKWAYS Not used.

PART 3 - EXECUTION

3.1. EXAMINATION

- A. Examine substrates, areas, and conditions with roofing membrane manufacturer's technical representative and Installer present, for compliance with requirements and other conditions affecting performance of work. Installer shall submit to roofing manufacturer all required drawings, details, and complete questionnaires for obtaining specified warranty.
- B. A job start observation will be required with roofing membrane manufacturer's technical representative present at project start. Representative shall witness actual roofing installation and submit a letter to General Contractor and Engineer stating that observed installation met recommendations of roofing manufacturer.

3.2. PREPARATION

- A. Set all drainage fixtures to proper elevation to permit free flow of water. Roof surfaces to be covered shall be smooth, hard, dry, and free from high spots, depressions, and frost or effects of frost. Roof surfaces are to be cleaned and free from dust, loosened cement scale, and debris. Examine roof surface for openings, holes, or crevice which might allow adhesives or sealants to drip or flow through or between deck and vertical projections. Where such openings occur, fill or covered before any roofing materials are applied.

3.3. ROOFING APPLICATION

- A. General: Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecasted. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Installation of Substrate Board: Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

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1. Install substrate board perpendicular to the direction of metal deck flutes, and all end joints are to be located over crests of metal roof deck.
 2. Substrate boards are to be tightly butted together.
 3. Substrate boards are to be cut as necessary to fit tight around penetrations and projections, and to fit tight to intersection sloping roof decks.
 4. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roofing according to manufacturer's written instructions.
 5. Substrate boards with vapor retarder shall not be used as a temporary roof.
- D. Vapor Retarder: Substrate boards shall be completely covered with a vapor retarder per the manufacturer's written recommendations. Vapor retarder shall be flashed at all penetrations, curbs, and parapets to prevent entry of moisture.
- E. Nailers: Nailers shall be as specified in the Rough Carpentry Section. Nailers shall be secured as specified by the roof membrane manufacturer and as specified by FM Bulletin 1-49. Wood nailers shall be installed at the locations specified herein, as indicated on Drawings, and as recommended by roof membrane manufacturer.
- F. Installation of Insulation: Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation. Insulation shall be dry when installed. No more insulation shall be installed than can be covered with roofing membrane before the end day's work or before the onset of inclement weather.
1. Unless otherwise indicated, base layer of insulation shall be laid over substrate board on metal deck with joints no wider than 1/4 inch. Joints wider than 1/4 inch shall be filled with insulation.
 2. Insulation boards shall be laid with joints staggered between parallel courses not less than 24 inches in adjacent rows, and if required, between layers. Abutting edges of boards shall be laid in moderate contact, not forced into place. At vertical surfaces, insulation shall be cut neatly to provide a clearance of not more than 1/4 inch.
 3. When two or more layer of composite and non-composite insulation are required, install bottom and intermediate layers as non-composite board insulation, and install top layer as composite insulation board.
 4. Base layer of insulation and substrate board shall be attached using mechanical fasteners specifically designed and sized for fastening specified board type roof insulation to metal decks.
 5. Base layer of insulation shall be adhered to vapor retarder.
 6. Install upper layers of insulation and tapered insulation with joint of each layer offset not less that 12 inches from previous layer of insulation.

Thermoplastic-Polyolefin (TPO) Roofing

- a. Tapered Insulation: Insulation boards for tapered systems shall be positioned in accordance with the manufacturer's layout to produce roof slopes and drainage patterns as indicated on Drawings. Thickness of insulation shall be based on the required R-value as indicated on Drawings.
 - b. Crickets: Not used.
- G. Installation of Cover boards: Cover boards are to be placed over all insulation. Install cover boards with long joints in continuous straight lines with end joints staggered between rows. Offset joint of insulation below a minimum 6 inches in each direction. Cover boards shall be attached as recommended by the membrane manufacturer's written instructions for wind loads specified.
- H. Installation of Roof Membrane: Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions. Position roofing membrane over insulation without stretching and allow to relax approximately 1/2 hour prior to bonding.
 1. Accurately position roof membrane and maintain uniform side and end laps at a minimum 3 inches with adjacent sheet.
 2. Adhesive shall be applied to membrane and underling substrate to securely bond the membrane to the board according to manufacturer's written instructions.
 3. Roof membrane shall be rolled to eliminate wrinkles, pockets, or voids.
 4. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter roofing.
 5. Seams in roof membrane and sheet flashing shall be cleaned and permanently joined at the overlap as recommended by membrane manufacturer to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 - b. Verify field strength of seams a minimum of twice daily, and repair seam sample area.
 - c. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements stated herein.
- I. Securing Perimeter Membrane: Sheets of roof membrane shall be secure at perimeter of each roof level, roof section, curb, skylight, expansion, joint, penthouse, and parapet wall, where required, using fastening strips or reinforced universal securement strips mechanically fastened through the membrane and insulation into the wood blocking or structural substrate as recommended by the membrane manufacturer.
- J. Installation of Base Flashing: Install sheet flashing at perimeter wall, roof edge, expansion joints, parapet, and curb flashing where required as recommended by roof membrane manufacturer.
 1. All pipe, conduits, or other roof penetrations shall be flashed with molded pipe flashings and the manufacturer's recommended water cutoff mastic.

Thermoplastic-Polyolefin (TPO) Roofing

- K. Installation of Walkways: Not used.

3.4. PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Engineer and Owner.
- B. Correct deficiencies or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

End of Section

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Sheet Metal Flashing and Trim

SECTION 076 00 - SHEET METAL

PART 1 - GENERAL

1-1. SCOPE. This section covers sheet metal associated with rainwater drainage and miscellaneous flashings around roof and wall openings. The following sheet metal items are covered in other sections:

- a. Ductwork, and other sheet metal for the heating, ventilating, and air conditioning system.
- b. Steel roof deck.

1-2. GENERAL. Installation of wall and roof flashings shall be as indicated on the Drawings.

Flashing members to be built into concrete or roofing shall be delivered at the proper time for incorporation into the work.

When installing sheet metal items, care shall be taken to avoid marring and improper bending. All components shall be stored in clean, dry storage areas. Contact with corrosive or staining materials shall be prevented. All damaged sections shall be replaced, and only undamaged units shall be installed.

1-3. SUBMITTALS. Complete specifications, data, and catalog cuts or drawings covering the items furnished under this section shall be submitted in accordance with the Submittal Procedures section.

PART 2 - PRODUCTS

2-1. MATERIALS.

| | |
|---------------------|--|
| Galvanized Steel | ASTM A366 or A569; hot-dip galvanized in accordance with ASTM A525, G90 minimum. |
| Stainless Steel | ASTM A167, Type 302 or 304, AISI 2B finish unless otherwise specified. |
| Sheet Aluminum | ASTM B209, Alloy 3003-H14, mill finish. |
| Extruded Aluminum | ASTM B221, Alloy 6053 or 6063. |
| Solder | ASTM B32, Alloy Grade 50A (50-50). |
| Soldering Flux | |
| For Stainless Steel | Zinc chloride type, Fed Spec 0-F-506, Type II. |
| For Other Metals | Acid type, Fed Spec O-F-506, Type I, Form A. |
| Fasteners | Same metal as sheet metal being fastened. |
| Plastic Cement | Asphalt roof cement, asbestos-free; ASTM D4586, Type II. |

Sheet Metal Flashing and Trim

| | |
|--|---|
| Coal Tar Epoxy | High-build coal tar epoxy; PPG Amercoat "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy". |
| Acrylic Sealant | Pecora "Unicylic" or Tremco "Mono". |
| 2-2. <u>EXPOSED METAL</u> . All exposed or contacting metal and flashings shall be of the same material. | |
| 2-2.01. <u>Types and Materials</u> . | |
| Parapet Coping | Firestone Building Products: Firestone Coping (Larger than 16" Wall Size Tapered Coping) Pre-finished, pre-manufactured .040 inch aluminum. Color to be selected by Engineer. |
| Fascia | Firestone Building Products: EdgeGard+Fascia, single application, snap-on version. Pre-finished, pre-manufactured .040 inch aluminum. Color to be selected by Engineer. |
| Counterflashings | Stainless steel, 26 gauge; Architectural Steel, Cheney, or Keystone, with wall flat and hook dam for masonry wall installation, with vertical receivers for surface-mounted installation, or with snap lock for reglet installation as indicated. |
| Downspouts | Pre-finished .032 inch aluminum with an oven baked 70 percent "Kynar 500" fluoro-polymer coating; flush surface, 5" X 5", complete with strap hangers. Color to match adjacent roof panel color. |
| Gutters | Pre-finished .032 inch aluminum with an oven baked 70 percent "Kynar 500" fluoro-polymer coating; 6-inch Style F shape (SMACNA) continuous lengths, complete with hangers and roof apron. Color to match roof panel color. |
| Reglets | Stainless steel, 26 gauge, designed to retain counterflashing by snap action or friction fit; Architectural Steel "Friction Reglet", Cheney "Type A", or Keystone "Simplex". |
| Miscellaneous Metal Flashings and Cap Flashings | Stainless steel, 26 gauge. |

Sheet Metal Flashing and Trim

2-3. PARAPET COPINGS & FASCIAS. Copings and fascias on roof edges and parapet walls shall be Firestone Building Products or approved equal. Copings and fascia shall be complete with welded miter corners, joint splice plates, covers and flashing, hold-down clips, and anchors and fasteners necessary for proper installation.

Site formed sheet metal will not be acceptable for coping. Alternate coping and fascia systems requiring exposed fasteners will not be acceptable.

Finish shall be a 30-year "Kynar 500" based fluopolymer coating. The coping color will be selected from manufacturer's standard and custom color charts.

2-4. GUTTERSCUPPERS AND DOWNSPOUTS. Metal gutters and downspouts shall be provided and installed as indicated on the Drawings and specified herein. The gutters and downspouts shall be furnished and installed complete with all accessories as specified or required to complete the installation. Gutters shall be coordinated with the installation of the roofing system to ensure a watertight installation.

Gutters and downspouts shall be well constructed, watertight, properly secured to the structure, and installed according to the Drawings and recommendations of SMACNA (latest edition). Downspouts shall be supported at the top and bottom and at 6'-0" maximum intermediate spacing. Downspouts shall have a 5" x 5" cross section.

Scuppers and downspouts shall be constructed from minimum .032 inch aluminum and shall have all exterior surfaces covered with a baked enamel finish. The color shall be selected by the Engineer from a manufacturer provided color chart or samples. Generically printed color sheets will not be acceptable for color selection. Different colors may be required for each building.

2-5. THROUGH-WALL FLASHING. Through-wall flashings shall be provided as indicated on the Drawings. Flashings under copings shall be continuous. Flashings over lintels and sills shall extend 8 inches past each jamb and shall have ends turned up ¼ inch. Joints in wall flashings shall overlap and shall be interlocked.

Where multiple bends are required for through-wall installation, as indicated on the Drawings, flashings may be provided in single-bend sections with vertical legs overlapped to drain to the outside face of the wall.

2-6. CAP FLASHINGS. Cap flashings shall be provided at all roof ventilators and elsewhere as indicated on the Drawings. Cap flashings shall be fabricated in sections not exceeding 10 feet in length; sections shall overlap at least 3 inches and shall form a slip joint but shall not be interlocked. All corners and all joints other than slip joints shall be closed watertight as specified herein.

2-7. COUNTERFLASHINGS. Counterflashings shall be provided, at the locations indicated on the Drawings, to overlap roof membrane base flashings and fit into flashing reglets or receivers.

Counterflashings shall be fabricated in sections not exceeding 10 feet in length; sections shall overlap at least 3 inches and shall form a slip joint but shall not be interlocked. End joints between counterflashing sections shall be offset from underlying joints between reglet or receiver sections. Corners in counterflashings shall be closed watertight as specified herein.

Sheet Metal Flashing and Trim

2-8. REGLETS. Reglets shall be provided at all locations indicated on the Drawings to receive counterflashings as shown. Reglets shall be fabricated in lengths not to exceed 10 feet and shall overlap at least 3 inches.

2-9. MISCELLANEOUS METAL FLASHING. Metal flashings shall be provided for vents, sleeves, and similar projections through the roof and walls.

PART 3 - EXECUTION

3-1. WATERTIGHT JOINTS. Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

3-2. PARAPET COPINGS & FASCIAS. Unless otherwise indicated on the Drawings or specified, roof fascia and parapet coping shall be installed in conformity with the instructions and recommendations of the manufacturer. Coping and fascia shall be installed with a 3/8-inch space between the end sections or as required by the coping manufacturer. The finished installation shall have a uniformly smooth vertical face in accurate alignment.

3-3. CAP FLASHINGS. Cap flashings shall be installed after membrane base flashings have been completed. Cap flashings shall be anchored in place as indicated on the Drawings.

3-4. COUNTERFLASHINGS. Counterflashings shall be installed after membrane base flashings have been completed. Counterflashings shall be fitted into reglets or receivers and securely locked in place in accordance with the manufacturer's recommendations.

3-5. REGLETS. Reglets to be set in concrete to receive counterflashings shall be nailed into the forms in accordance with the manufacturer's recommendations, with care being taken to maintain precise alignment of abutting sections. After the forms are stripped, the temporary form filler strip shall be removed from the reglet and the form securing nails shall be clipped flush.

3-6. GUTTERS SCUPPERS AND DOWNSPOUTS. The gutters and downspouts shall be as indicated on the Drawings and specified herein. All joints in gutters and downspouts shall be watertight. Downspouts shall have bottom terminations canted outward away from the wall for discharging onto splash blocks or shall be terminated straight down to site drainage piping where indicated on the Drawings..

3-7. PROTECTION. Adequate protection shall be provided during shipment, site storage, and installation, to prevent damage to materials or finished work.

Aluminum to be placed in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

End of Section

Joint Sealants

SECTION -07 2900- JOINT SEAL ANTS

PART 1 - GENERAL

1-1. SCOPE. This section covers caulking and sealing. Fire rated caulking is covered in the Fireproofing section.

1-2. GENERAL. The terms "caulking" and "sealing", as used on the Drawings and in these Specifications, are synonymous. Both terms indicate the materials specified herein. Oil-base caulking shall not be used on this Project.

1-3. APPROVALS. All caulking shall meet the requirements of the standards specified herein. All caulking and sealing to be used in contact with potable water shall meet the requirements of ANSI/NSF Standard 61.

1-4. SUBMITTALS. Specifications and data covering the materials proposed for use, together with samples or color cards showing the manufacturer's full line of sealant colors, shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. MATERIALS.

| | |
|---|---|
| Thiokol Sealants (polysulfides) | Fed Spec TT-S-00227E, Class A or ASTM 920 Type M; polysulfide rubber, two component. |
| Nonsag | |
| Submerged Service, Non potable water | Pecora "Synthacalk GC-2+". |
| Nonsubmerged Service | Pecora "Synthacalk GC-2+"; Polymeric Systems "PSI-350". |
| Self-Leveling, nonsubmerged | A. C. Horn "Hornflex Traffic Grade"; Polymeric Systems "PSI-350". |
| Urethane Sealants (Polyurethanes) | Fed Spec TT-S-00227E, Class A, Type 2 and ASTM C920, Type M, Grade NS, two component. |
| Nonsag | |
| Submerged Service | |
| Potable Water | Polymeric Systems "RC-270"; Sika "Sikaflex-2cNS. |
| Nonpotable Water | Polymeric Systems "RC-270". |

Joint Sealants

| | |
|--|---|
| Nonsubmerged Service | Bostik "Chem-Calk 500"; Tremco "Vulkem 227"; Pecora "Dynatrol II"; Tremco "DYmeric 240"; Sika "Sikaflex-2cNS". |
| Self-Leveling, Nonsubmerged Service | Bostik "Chem-Calk 550"; Tremco "Vulkem 245"; Pecora "Urexpan NR-200"; Polymeric Systems "RC-2SL"; Tremco "THC-900". |
| Acrylic Sealant | Fed Spec TT-S-230; ASTM C834. Bostik "Chem-Calk 600"; Pecora "AC20"; Tremco "Mono 555". |
| Primer | As recommended by the sealant manufacturer. |
| Backup Material | Polyethylene or polyurethane foam as recommended by the sealant manufacturer; Dow "Ethafoam SB" or Plateau "Denver Foam". |
| Bondbreaker Tape | Adhesive-backed polyethylene tape as recommended by the sealant manufacturer. |

2-2. COLORS. Colors of sealants shall be as selected by Engineer from the manufacturer's standard line of colors. Different colors may be required for different locations.

2-3. LOCATIONS TO BE CAULKED.

2-3.01. With Thiokol or Urethane Sealant (Nonsag) - Submerged Service.

All joints requiring caulking in submerged locations.

Surface of basin weir plates in contact with supporting structure.

2-3.02. With Thiokol or Urethane Sealant (Nonsag) - Nonsubmerged Service.

Entire perimeter of frames for exterior metal doors.

Entire perimeter of metal louvers.

Entire perimeter of metal dampers and metal shutters.

Entire perimeter of aluminum windows.

Control joints in masonry walls.

Perimeter of aluminum entrances and assemblies, except exterior side of exterior sills.

Joints on the underside of prestressed, precast roof members where exposed to view.

Around service sinks.

Joint Sealants

Joints between masonry and cast-in-place concrete, where indicated on the Drawings.

Other locations where caulking is indicated on the Drawings, specified in other sections, or required for weatherproofing.

2-3.03. With Thiokol or Urethane Sealant (Self-Leveling).

Horizontal joints in walks or drives.

Horizontal joints in traffic-bearing decks and slabs.

Annular space around handrail posts set in sleeves.

2-3.04. With Acrylic Sealant.

Watertight joints in sheet metal work.

PART 3 - EXECUTION

3-1. JOINT PREPARATION. All surfaces to receive sealant shall be clean, dry, and free from dust, grease, oil, or wax. Concrete surfaces which have been contaminated by form oil, paint, or other foreign matter which would impair the bond of the sealant to the substrate shall be cleaned by sandblasting. All surfaces shall be wiped with a clean cloth saturated with xylol or other suitable solvent, and shall be primed before the sealant is applied.

Unless otherwise recommended by the sealant manufacturer and permitted by the Engineer, the depth of sealant in a joint shall be equal to the width of the joint, but not more than 1/2 inch. Backup material shall be provided as necessary to control the depth of sealant and shall be of suitable size so that, when compressed 25 to 50 percent, the space will be filled. Backup material shall be rolled or pressed into place in accordance with the manufacturer's installation instructions, avoiding puncturing and lengthwise stretching. If depth of the joint does not permit use of backup material, bondbreaker tape shall be placed at the bottom of the joint to prevent three-sided adhesion.

3-2. SEALING. Sealing work shall be done before any field painting work is started. The air temperature and the temperature of the sealed surfaces shall be above 50°F when sealing work is performed.

Upon completion of the sealing work, each sealed joint shall have a smooth, even, tooled finish, flush with the edges of the sealing recess, and all adjacent surfaces shall be clean. Sealant shall not lap onto adjacent surfaces. Any sealant so applied as to prevent the painting of adjacent surfaces to a clean line, or with an excess of material outside the joint and feathered onto surfaces, shall be removed and the joint resealed.

End of Section

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SECTION 08 1114 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

- 1-1. SCOPE. This section covers the furnishing and installation of hollow metal doors and frames. Unless otherwise indicated or specified, all steel doors shall be flush type.
- A. Structural steel door frames, glazing, and finish hardware are covered in the Structural and Miscellaneous Metals section, the Glass and Glazing section, and the Finish Hardware section, respectively.
 - B. GENERAL. Doors, frames, and appurtenances shall be furnished and installed as specified herein and in accordance with the details and arrangements indicated on the Drawings.
 - 1. Doors, frames, and appurtenances furnished under this section shall be fabricated and assembled and erected, in full conformity with Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer unless exceptions are noted by Engineer.
 - 2. Product Schedule: For hollow metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with finish hardware schedule.
- 1-2. SUBMITTALS.
- A. General Submittals:
 - 1. Complete detail drawings of all items specified herein shall be submitted in accordance with the Submittals Procedures section. Drawings shall show elevations of each door type; details of each frame type; location or identification of each item; typical and special details of construction; methods of assembling sections; location and installation requirements for hardware; size, shape, and thickness of materials; joints; connections; and finish.
- 1-3. DELIVERY, STORAGE, AND HANDLING.
- A. Shipping shall be in accordance with the Product Deliver Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.
 - B. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damages of any kind. Damaged materials shall be promptly replaced.
 - C. Storage of Doors and Frames:
 - 1. Provide proper storage for doors and frames to maintain quality, integrity of factory applied paint, and maintain the requirements of ANSI/SDI A250.10 and HMMA 840.

Steel Doors and Frames

2. Doors and frames to be stored vertically in dry area and under proper cover and placed at least 4 inches high on wood sills to prevent rust and damage. Doors must be stored in a well-ventilated area to minimize humidity levels to prevent rusting. If door

1-4. QUALITY ASSURANCE.

- A. Fire Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire rated door assemblies shall meet the qualification set forth in NFPA 80, Section 5.2.3.1 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1-5. COORDINATION.

- A. Coordinate work with other section that are directly involving the manufacturing or fabrication of internal cutout and reinforcement for finish hardware, electric door hardware, and recessed hardware.
- B. Frame opening construction to be coordinated with door and hardware installation.
- C. Field verify all openings prior to factory assembly and fabrication of frames.
- D. For doors and frames that require electrified hardware, coordinate electrical requirements for doors and frames. Make provisions for installation of electrical items so that wiring can be readily removed and replaced. Refer to the Finish Hardware Section for more information.

PART 2 – PRODUCTS

2-1. PERFORMANCE AND DESIGN CRITERIA.

- A. Governing Standard. Except as modified or supplemented herein, all steel doors and frames shall conform to the requirements of ANSI/SDI 100, Level 2, Model 2.
- B. Metal Thicknesses. Metal thicknesses and gauges of steel sheet metal specified herein are the minimum required. Gauges refer to US Standard gauge.
- C. Nomenclature. The nomenclature used herein conforms to ANSI/SDI A250.8.
- D. Fire Rated Door Assemblies: Not used.

Steel Doors and Frames

- E. Fire Rated, Borrowed Lite Assemblies: Not used.
- F. Thermally Rated Door Assemblies: Provide door assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq.ft. when tested according to ASTM C518.
- G. (Tornado) Storm Resistant Door Assemblies: Not used.
- H. (Hurricane) Storm Resistant Door Assemblies: Not used.

2-2. ACCEPTABLE PRODUCTS.

- A. Manufacturers:
 - 1. Ceco Door; an ASSA ABLOY Group
 - 2. Curries; an ASSA ABLOY Group
 - 3. Steelcraft; Allegion plc.
 - 4. Or approved equal.

2-3. METAL DOORS

- A. Doors indicated on the Drawings as hollow metal, including doors with glazed and louvered openings, shall be as specified herein. Doors shall be prepared to receive the hardware specified in the Finish Hardware section.
- B. Workmanship: Doors shall be rigid, neat in appearance, and free from defects. Molded members for glazed doors shall be formed straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so that they are invisible after finishing.
- C. Door Construction: Materials used in the manufacturing of steel doors shall be as follows:
 - 1. Steel Thickness and Type: Hot dipped galvanized steel; ASTM A653/A653M; G90 coating; 18 gauge.
 - 2. Size and Clearance: 1-3/4 inch thickness; 1/8 inch clearances at jambs and head, 1/4 inch at meeting stiles for pair of doors; 3/4 inch clearance at door bottom unless otherwise noted or indicated on Drawings. Clearances for fire doors shall be as indicated by NFPA 80 or by the authority having jurisdiction.
 - 3. Door Core: Rigid polystyrene or injected polyurethane foam.
 - 4. Door Edges: Beveled or rounded.
 - a. All doors to have welded vertical edges with continuous vertical mechanical interlocking joints. Edge seams are to be welded, filled with structural adhesive, and ground smooth.

Steel Doors and Frames

5. Internal Reinforcing: ASTM A1008/A1008M, cold-rolled steel; 20-gauge vertical steel stiffeners, spaced 6 inch centers, welded to face sheets. Insulation/fillers placed between reinforcing.

D. (Tornado) Storm Resistant Doors: Not used.

E. (Hurricane) Storm Resistant Doors: Not used.

F. Hardware Provisions: Doors shall be mortised, reinforced, drilled, and tapped for mortised hardware. Reinforcing units shall be provided for locksets. Reinforcing plates shall be provided for mortised and surface-applied hardware in at least the following thicknesses:

| | |
|--|---------|
| Hinge reinforcement | 10 gage |
| Surface-applied closers and hold-open arms | 12 gage |
| Other reinforcement | 14 gage |

G. Stops and Beads: Metal glazing beads shall be furnished with hollow metal doors where glazed doors are indicated on the Drawings. Glazing stops may be formed as an integral part of the doors, or separate glazing beads provided for both sides of the glass. Doors shall be prepared to receive the glazing beads. Beads shall be snapped into place, or shall be fastened with oval-head machine screws spaced at 9 inch centers maximum. Beads having a molded shape shall be mitered at corners. Rectangular beads may be either mitered or butted at corners.

1. Where glazed doors are exposed to weather, all seams and joints on all sides of the glass panel, except joints in removable beads, shall be closed watertight as specified for side edges.

H. Astragals: The meeting edges of all exterior double doors, of interior double doors scheduled to be weatherstripped shall be provided with astragals.

I. Louvers: Not used.

J. Transom Panels: Not used.

2-4. METAL FRAMES:

A. Frames for doors, transoms, sidelights, mullions, and interior glazed panels shall be formed of steel to the sizes and shapes required.

B. Workmanship. The finished work shall be strong, rigid, neat, and free from defects. Molded members shall be fabricated straight and true, with corner joints well formed, and with fastenings concealed where practicable.

C. Frame Construction:

1. Steel Thickness and Type: Hot dipped galvanized steel; ASTM A653/A653M; G90 coating; 14 gauge.

Steel Doors and Frames

2. Joints: Joints shall be mitered or butted and continuously welded on the reverse side to produce rigid joints which are invisible on the face of the frame. Frame bottoms shall be held rigidly in position by spreader bars to maintain proper alignment during shipment and erection.
3. Hardware Provisions: Frames shall be mortised, reinforced, drilled, and tapped for mortised hardware, and shall be reinforced for surface-applied hardware. Cover boxes shall be provided in back of all hardware cutouts. Frames for all doors except weatherstripped doors shall be punched to receive silencers, three holes on the lock side of single door frames and one hole for each leaf in heads of double door frames. Lock strikes shall be set out and adjusted to provide clearance for silencers.
4. Concealed metal reinforcement shall be provide for hardware in at least the following thickness:

| | |
|----------------------|----------|
| Hinge reinforcement | 10 gauge |
| Strike reinforcement | 14 gauge |
| Closer reinforcement | 12 gauge |
| Other reinforcement | 14 gauge |

- D. Frame Anchors: Metal anchors of the sizes and shapes required for the adjoining type of wall construction shall be provided. Jamb anchors shall be fabricated from steel, of at least the same thickness as the frames. Anchors shall be located near the top and bottom of each frame and at intermediate points spaced not more than 24 inches apart.
1. For frames set in masonry, jamb anchors shall be at least 10 inches long, adjustable, and corrugated or other deformed type.
 2. For frames set in metal stud partitions, anchors shall be welded to the backs of frames. Anchors shall be fastened to steel studs with 1/4 inch diameter machine bolts, or by welding.
 3. For frames set in hardened concrete or existing masonry walls, anchorage shall be provided as indicated on the Drawings.
 4. Door frames shall be provided with a 16 gauge thick base clip at each jamb for floor anchorage. Clips shall be sized and drilled for at least two 3/8 inch diameter anchoring devices. Where floor fill occurs at a door opening, the bottom of the frame shall terminate at the indicated finished floor level and shall be supported by adjustable extension clip angles anchored to the structural slab.
- E. Borrowed Lites: Not used.
- F. Mullions and Transom Bars: Not used.

Steel Doors and Frames

- G. Reinforcing: Where structural steel members are indicated at mullions, transoms, or other locations, and are required to be built into hollow metal frames, the structural steel shapes shall be provided as part of the frame assembly.
- H. Stops and Beads: Metal glazing beads shall be furnished with hollow metal frames at transoms, sidelights, interior glazed panels, and other locations where glazed frames are indicated on Drawings. Glazing stops shall be formed as an integral part of the frames, and the frames shall be prepared to receive the glazing beads. Where frames are exposed to weather, integral stops shall be located on the exterior side of the frames. Beads having a molded shape shall be mitered at corners. Rectangular beads may be either mitered or butted at corners.

2-5. STEEL FINISHES:

- A. A primer shall be applied to all surfaces of ferrous metal furnished under this section. Metal surfaces shall be cleaned and given a phosphate or equivalent treatment to ensure maximum corrosion protection and paint adherence. A dip or spray coat of synthetic resin, rust-inhibitive metallic oxide, or rust-inhibitive zinc chromate primer shall be applied to all surfaces, then baked or oven-dried in accordance with ANSI/SDI A250.10 "Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames. Finished surfaces shall be smooth and free from irregularities.

PART 3 – EXECUTION

3-1. INSTALLATION:

- A. ANSI A250.11; Install doors and frames in accordance with Steel Door Institute's recommended erection instructions for steel frames.
- B. Install labels for doors and frames in accordance with NFPA 80.
- C. Frames shall be set in position, plumbed, aligned, and braced securely until permanent anchors are set. Remove temporary woodspreader after wall construction is complete.
 - 1. Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
- D. Hardware to be applied in accordance with hardware manufacturers' instructions and Finished Hardware section of these Specifications. Install all hardware with only factory provided fasteners. Adjust door installation to provide uniform clearance at head and jambs, to achieve maximum operational effectiveness and appearance.

3-2. ADJUSTING:

- A. Doors and hardware are to be adjusted prior to final inspection and acceptance by the Owner and Architect. Leave work in complete and proper operating condition. All

Steel Doors and Frames

defective work, including doors or frames that are damaged, bowed or otherwise unacceptable are to be removed and replaced.

- B. Sand smooth any rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer immediately after erection.

3-3. PROTECTION:

- A. Provide protective measures required throughout the construction period to ensure that door and frame units will be without damage or deterioration, other than normal weathering, at time of acceptance.

End of Section

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Aluminum Windows

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SCOPE.

- A. This section covers aluminum window assemblies.
- B. Glass and Glazing is covered in the Glass and Glazing section. Caulking is covered in the Joint Sealants section. All door functions shall be coordinated with Owners physical security guidelines.

1.2 GENERAL.

- A. Aluminum windows shall be furnished and installed as specified herein and in accordance with the details and arrangements indicated on the Drawings.
- B. For fixed glass areas, air infiltration shall not exceed 0.06 cfm/ft² for fixed glass areas when tested in accordance with ASTM E283. Additionally, when tested in accordance with ASTM E331, there shall be no water penetration at a minimum static air pressure differential of 12 psf as defined in AAMA 501.
- C. A static air service level design load of 40 psf shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of L/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.4% of their clear spans shall occur.

1.3 SUBMITTALS.

- A. Drawings and Data
 - 1. Complete specifications and drawings covering the aluminum framed assemblies shall be submitted in accordance with the Submittals Procedures section. Drawings shall show an elevation of each assembly, details of construction, assembly and installation details, profiles and thickness of materials, anchors, reinforcements, and finish. Drawings shall be accompanied by the manufacturer's installation manual containing standard recommendations and details of installation.

PART 2 - PRODUCTS

2.1 MATERIALS. Materials used in aluminum assemblies shall be as follows:

A. Aluminum Windows

1. Aluminum

a. Extrusions

1) ASTM B221, Alloy 6063-T6; tubular sections min 1/8 inch thick.

b. Sheet Fasteners

1) Manufacturer's standard.

2. Glazing Gaskets

a. Extruded EPDM rubber, replaceable.

3. Anchors

a. Aluminum, nonmagnetic stainless steel, or zinc-coated steel complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

2.2 ACCEPTABLE PRODUCTS.

A. Aluminum windows shall be as manufactured by Kawneer, Special-Lite, Tubelite, or United States Aluminum. For ease of identification, the Drawings and Specifications are based on products manufactured by Kawneer. Similar and equal products of other manufacturers may be provided. Unless otherwise accepted by the Engineer, doors and assemblies shall conform to the details, arrangements, and dimensions indicated on the Drawings and specified herein.

2.3 CONSTRUCTION.

A. Assemblies.

1. Aluminum windows shall be as specified herein and detailed on the Drawings.

2. The exterior aluminum windows shall be Kawneer "Trifab 601T" thermal framing system or and interior aluminum assemblies shall be Kawneer "InFrame" interior framing system. Exterior assemblies shall be 2-inch by 6-inch and designed for 1-inch glazing, and interior assemblies shall be 2-inch by 4-inch with 1/2-inch glazing. Special sized framing members shall be provided where indicated on the Drawings.

3. Aluminum windows shall be fabricated from extruded tubular shapes. Frames shall be fabricated and factory assembled in as large sections as practical, consistent with shipping and installation requirements. All miters and joints shall form flush hairline

Aluminum Windows

joints, utilizing concealed fastenings, where practicable. Where the use of exposed screws, bolts, or rivets cannot be avoided, heads shall be countersunk and finished to match adjacent work.

4. All standard and special clips, angles, and other connections or attachment members shall be furnished as indicated, specified, or required for proper installation.
5. Extended sills matching the finish of the associated framing assembly shall be provided where indicated on the Drawings for window assemblies.

B. Operable Window Assemblies. Not used.

C. Doors. Not used.

D. Sliding Doors. Not used.

E. Glazing Provisions.

1. Aluminum windows shall be designed for glazing as indicated on the Drawings. Glazing gaskets shall be furnished by the aluminum assembly manufacturer. Glazing stops for doors shall be snap-in type with provisions for extruded bulb-type glazing. Stops on exterior side shall be lock-in tamperproof type.

F. Finish.

1. Exposed surfaces of aluminum windows shall be given a Kynar 500 fluoropolymer finish meeting the requirements of AAMA 2605, with all adjacent components carefully selected for color match. The color shall be selected by the Engineer from the manufacturer's full line of colors. The manufacturer shall supply a color wand or cards for color selection. Generically printed color sheets will not be acceptable.

2.4 HARDWARE. Not used.

PART 3 - EXECUTION

3.1 INSTALLATION.

- A. Framing members shall be installed plumb and true by skilled mechanics in accordance with the manufacturer's recommendations and the instructions in standard installation manuals, subject to the following modifications.
- B. Framing members shall be anchored to concrete and solid masonry units by expansion anchors, to hollow masonry units by toggle bolts, and to steel by machine screws. Anchors for head, jamb, and sill members shall be spaced not more than 24 inches apart.
- C. Member-to-member connections shall be made with appropriate profile clips or with aluminum angles at each side or level of the members jointed. Each clip or angle shall be fastened to each

Aluminum Windows

member with at least two stainless steel or zinc plated screws. Connections exposed to weather shall be watertight and shall be sealed during installation in accordance with the manufacturer's recommendations and standard details.

- D. Glazing stops, removable stops, weatherstripping, and other accessories shall be secured with countersunk machine screws.
- E. Aluminum surfaces that are to be placed in contact with concrete, mortar, plaster, or dissimilar metals shall be given a coat of coal tar epoxy.
- F. Hardware shall be carefully and properly installed, doors shall be hung, and each item of hardware shall be lubricated and adjusted for perfect operation.

3.2 PROTECTION AND CLEANING.

- A. Framing assemblies shall be protected during fabrication, shipment, site storage, and installation to prevent damage to materials or finished work. Damaged framing members will be rejected and shall be replaced with satisfactory units.
- B. After completion of construction, protective materials shall be removed and all aluminum work shall be washed with a mild solution of soap and water and then rinsed with clean water.

END OF SECTION

Finish Hardware

SECTION 08 71 00 - FINISH HARDWARE

PART 1 – GENERAL

1-1. SCOPE.

A. This section includes electrified door hardware for FRP doors and frames.

1. All door functions shall be coordinated with Owners physical security guidelines.

1-2. GENERAL.

A. Items in this section shall conform with the following:

1. 2021 International Building Code, with local amendments; NFPA 70, NFPA 80, NFPA 101, ANSI/BHMA Certified Product Standards – A156 Series.

1-3. SUBMITTAL.

A. Contractor shall submit the following in accordance with the requirements specified in the Submittal Procedures Section:

1. Product Data: For each type of product indicated.
2. Shop Drawings: Details for electrified door hardware.
3. Samples: For each exposed product and for each color and texture specified.
4. Door Hardware Schedule: Prepared by or under the supervision of the Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Use same scheduling sequence and format and used same door numbers as in stated in the Contract Documents.
 - b. Content: Include the following:
 - c. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - d. Locations of each door hardware set cross-referenced to Drawings on Floor Plans and Door Schedule.
 - e. Complete designations, including name and manufacturer, type, style, function, size, quantity, and finish of each door hardware product.
 - f. Description of electrified door hardware sequences of operations and interfaces with other building control systems.
 - g. Keying Schedule: Prepared by or under the supervision of Installer detailing Owner's final keying instructions for locks.

Finish Hardware

1-4. QUALITY ASSURANCE.

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
- B. Keying Conference: Conduct conference at Owner's designated site to coordinate Owner's keying requirements. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.
 - 4. Requirements for access control.
 - 5. Delivery of keys and permanent cylinders.

1-5. PACKAGING:

- A. Each item of hardware shall be package separately in an individual container complete with screws, keys, special wrenches, instructions, and installation templates necessary for accurately locating, setting, adjusting and attaching the hardware. Each container shall be marked with the numbered opening to which the hardware item is to be applied.

1-6. COORDINATION:

- A. Templates: Obtain and distribute to the parties involved templates for the door, frames, and other work specified to be factory prepared for installing mechanical and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparations: Related to Division 08 Sections, all doors and frames are to be prepared, reinforced, and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling, and access control system hardware without additional in-field modifications.
- C. Security: Coordinate installation of door hardware and keying with Owner.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety security systems.
- E. Existing Opening: Not used.

Finish Hardware

1-7. WARRANTY:

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of the rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of mechanical and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven (7) years for heavy duty cylindrical locks and latches.
 - 2. Five (5) years for exit hardware.
 - 3. Ten (10) years for manual door closers.

PART 2 – PRODUCTS

2-1. MANUFACTURER:

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2-2. PERFORMANCE REQUIREMENTS:

- A. Fire-Rated Door Assemblies: Not used.
- B. Smoke and Draft-Control Door Assemblies: Not used.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Finish Hardware

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require the use of a key, tool, or special knowledge for operation.

2-3. ACCEPTABLE MANUFACTURES: The catalog numbers which appear in Part 3 “Door Hardware Schedule” Article identifies products listed manufacturers herein for each hardware item. Equivalent products of the other manufacturers listed herein will also be acceptable. Where Specification refers to a product or manufacturer as an Owner Standard, substitutions will not be allowed.

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow metal frames.

1. Manufacturers:

- a. **IVES Hardware; Allegion plc. (IVE)**
- b. Hager Companies (HAG)
- c. McKinney Products Company, an ASSA ABLOY Group company. (MCK)
- d. Stanley Commercial Hardware; a division of Stanley Security Solutions. (STA)
- e. Or approved equal.

2. Quantity: Provide the following hinge quantity:

- a. Two (2) Hinges: For doors with heights up to 60 inches
- b. Three (3) Hinges: For doors with heights 61 to 90 inches.
- c. Four (4) Hinges: For doors with heights 91 to 120 inches.
- d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

3. Hinge Weight and Base Material: Heavy weight, made of non-ferrous materials, ball bearing or oil impregnated bearing hinges unless Hardware Set indicated standard weight.

4. Hinge Options: Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed.

5. Electrified Functions for Hinges: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.

B. Mechanical Locks and Latches: Mortise Locks: BHMA A156.2; Grade 1; Series 4000, tested to meet or exceed 250,000 cycles.

1. Requirements:

- a. Latchbolt: Steel with minimum 1/2 inch throw deadlatch on keyed and exterior functions; 3/4 inch throw anti-friction latchbolt on pairs of doors.
- b. Strikes: Provide manufacturer’s standard strike, ANSI curved lip, 1-1/4 inch x 4-7/8 inch, 16 gauge, with 1 inch deep box construction, for each lock bolt or latchbolt.

Finish Hardware

2. Manufacturers:
 - a. Corbin Russwin, Inc.; an ASSA ABLOY Group company (COR)
 - b. SARGENT Manufacturing Company; ASSA ABLOY (SGT)
 - c. Schlage Lock Company; Allegion plc. (SCH)**
 - d. Yale Security Inc.; an ASSA ABLOY Group company (YAL)
 - e. Or approved equal.
- C. Electric Strikes: BHMA A156.31 ; Grade 1; with faceplate to suit lock and frame. Manufacturer to be same or compatible with lockset system.
- D. Electrified Locksets: BHMA A156.25 ; Grade 1; motor or solenoid driven; with strike that suits frame.
 1. Manufacturer:
 - a. Best Access Systems; Stanley Security Solutions, Inc (BAS)
 - b. SARGENT Manufacturing Company; ASSA ABLOY (SGT)
 - c. Schlage Lock Company; Allegion plc. (SCH)**
 - d. Yale Security Inc.; an ASSA ABLOY Group company (YAL)
 - e. Or approved equal
- E. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 1. Product: Provide factory registered restricted key system.
 2. Supplier to verify appropriate keyway prior to ordering locks or cylinders.
- F. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. New Master keyed system. Incorporate decision made in keying conference.
 1. Small Format Interchangeable Core (SFIC)
 - a. Construction core provided by supplier.
 - b. Permanent core provided by owner.
 2. Matching cylinder locks shall be provide for the aluminum entrances.
- G. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1; except with extended cycle performance testing certified for minimum 8,000,000 cycles; listed by UL for accident and hazard; and conforming to applicable requirements of NFPA 80 and NFPA 101.
 1. Requirements:
 - a. Internal springs: Coil compression type
 - b. Provide security dead latching for active latch bolts
 - c. Latch Bolts: Self-lubricating coating to reduce friction and wear. Plated latchbolts are not acceptable.
 - d. Touch Pad: Stainless steel with return strok fluid dampers and rubber bottoming dampers.

Finish Hardware

- e. Provide filler plates and shim kits as needed for flush mounting of devices on doors.
 - f. Devices with exposed rivets or screws on back of device that would be visible through a glass light are not acceptable.
2. Manufacturers:
- a. Corbin Russwin, Inc.; an ASSA ABLOY Group company (COR)
 - b. SARGENT Manufacturing Company; ASSA ABLOY. (SGT)
 - c. **Von Duprin; Allegion plc. (VON)**
 - d. Yale Security Inc; an ASSA ABLOY Group company
 - e. Or approved equal
- H. Surface Closers: BHMA A156.4; Grade 1; except tested to exceed 10 million (10,000,000) full load operating cycles by an independent laboratory.
1. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather and anticipated frequency of use.
 2. Provide factory-sized rack-and-piston hydraulic type closers that are adjustable to meeting field conditions and requirements for opening force.
 3. Provide closers constructed with high strength cast iron cylinders, forged main arms, and one piece forged steel pistons, with adjustable sweep and latch speeds controlled by key-operated valves and forged steel main arm.
 4. Cylinder Body: 1-1/2 inch piston diameter with 3/4 inch journal double heat treated shaft, 5/8 inch full complement bearing, chrome silicon steel spring.
 5. Hydraulic Fluid: ULTRA X™ Fluid with constant temperature control from +120°F to -30°F
 6. Closers with pressure release valves are not acceptable.
 7. Manufacturers:
 - a. Corbin Russwin, Inc.; an ASSA ABLOY Group company (COR)
 - b. **LCN Closers; Allegion, plc. (LCN)**
 - c. Norton Door Controls; an ASSA ABLOY Group company (NOR)
 - d. SARGENT Manufacturing Company; ASSA ABLOY. (SGT)
 - e. Or approved equal.
- I. Mechanical Stops and Holders: Wall and floor mounted stops; BHMA A156.16. Provide door stops for all doors in accordance with the following requirements:
1. Provide convex type wall stops wherever possible.
 2. Where wall stops cannot be used, provide floor stops of the proper height.
 3. At openings where wall or floor stops cannot be used, provide overhead stops.

Finish Hardware

4. Manufacturers:

- a. Hager Companies. (HAG)
- b. IVES Hardware, Allegion, plc. (IVE)**
- c. Rockwood Manufacturing Company; an ASSA ABLOY Group company (ROC)
- d. Or approved equal.

J. Overhead Stops and Holders: BHMA A156.8

1. Manufacturers:

- a. Architectural Builders Hardware Mfg., Inc. (ABH)
- b. Glynn-Johnson; Allegion, plc. (GLY)**
- c. Rockwood Manufacturing Company. (ROC)

K. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Maximum Air Leakage: When tested in accordance with ASTM E283 with tested pressure differential of 0.3 inch wg , as follows:

- a. Smoke-Rated Gasketing: 0.3 cfm/sq.ft. of door opening.
- b. Gasketing on Single Doors: 0.3 cfm/sq.ft. of door opening.
- c. Gasketing on Double Doors: 0.50 cfm/sq.ft. of door opening.

2. Manufacturers:

- a. Hager Companies. (HAG)
- b. Pemko; an ASSA ABLOY Group company (PEM)
- c. Reese Enterprises, Inc. (REE)
- d. Zero International; Allegion, plc. (ZER)**
- e. Or approved equal

L. Thresholds: BHMA A156.21; Fabricated to full width of opening indicated.

1. Manufacturers:

- a. Hager Companies. (HAG)
- b. Pemko; an ASSA ABLOY Group company (PEM)
- c. Reese Enterprises, Inc. (REE)
- d. Zero International; Allegion, plc. (ZER)**
- e. Or approved equal

2-4. FABRICATION:

- A. Fasteners: provided for door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screw that comply with commercially recognized industry standards for application intended, except aluminum

Finish Hardware

fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

- B. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow metal doors and frame construction, provide sleeves for each through bolt.
- C. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
- D. Gasketing Fasteners: Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

2-5. FINISHES:

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule. Exterior surfaces of door closers shall be finish painted with shop-applied powder coated finish, plated finishes, or special coatings as indicated in the door hardware schedule. Machine screws, bolts, and other exposed attachments shall be finished to match hardware. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping. Stainless steel finish at highly corrosive areas.

PART 3 – EXECUTION

3-1. HARDWARE INSTALLATION:

- A. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been complete on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation
 - 2. Drill and counter sink nits that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standard.
- B. Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- C. Mounting Height: Mount door hardware units at heights indicated or as required to comply with ANSI/SDI A250.8.
- D. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

Finish Hardware

- E. Lock Cylinders: Install construction cylinders to secure building and areas during construction period.
- F. Thresholds: The ends of thresholds shall be notched to fit the applicable door frame profile. Thresholds shall be field drilled to receive flush bolts where required. Thresholds shall be anchored to concrete by means of 5/16 inch diameter stainless steel flat head countersink machine screws and expansion anchors spaced every 8 inches on center. Set threshold for exterior door and other doors indicated in full bed of sealant complying with requirements specified in Section [07 9000 "Joint Sealant."
- G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- J. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of each unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilation equipment and to comply with referenced accessibility requirements.

3-2. FIELD QUALITY CONTROL:

- A. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3-3. PROTECTION: Special care shall be taken to protect finished surfaces of hardware during installation. Hardware on which the finish has been damaged prior final acceptance of the work shall be replaced with new hardware at no additional cost to the Owner.

Finish Hardware

3-4. DOOR HARDWARE SCHEDULE:

Hardware Group No. 01

For use on Door #(s):

69-101B

Exterior, SGL door, 3'-0" x 7'-2", Locked, Panic, Card Reader Access

| QTY | | DESCRIPTION | CATALOG NO. | FINISH | MFR |
|-----|-----|-------------------------------------|----------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | PANIC HARDWARE | 9875-L-NL-06 | 630 | VON |
| 1 | EA | SFIC RIM HOUSING | 80-129 | 626 | SCH |
| 1 | EA | SFIC | PROVIDED BY OWNER | 630 | |
| 1 | EA | ELECTRIC STRIKE | 6300 FSE | 630 | VON |
| 1 | EA | SURFACE CLOSER (w/ OH hold open) | 4040XP HCUSH SRI | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 188SBK PSA | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 566A | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05 | WHT | SCH |
| 1 | EA | POWER SUPPLY | PS902 900-2RS | LGR | SCH |

Hardware Group No. 02

For use on Door #(s):

69-101A

Exterior, PR door, 3'-0" x 9'-2" Locked, Panic, Card Reader Access

| QTY | | DESCRIPTION | CATALOG NO. | FINISH | MFR |
|-----|-----|-------------------------------------|-----------------------|--------|-----|
| 8 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | POWER TRANSER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | EL9827-L-NL-06 | 630 | VON |
| 1 | EA | SFIC RIM HOUSING | 80-129 | 626 | SCH |
| 1 | EA | SFIC | PROVIDED BY OWNER | 630 | |
| 1 | EA | REMOVABLE MULLION | PROVIDED BY DOOR MFGR | | |
| 2 | EA | SURFACE BOLTS | 585-12 & 585-24 | 626 | ROC |
| 1 | EA | SURFACE CLOSER (w/ OH hold open) | 4040XP HCUSH SRI | 689 | LCN |
| 1 | EA | OVERHEAD HOLD | 90H | 630 | GLY |
| 2 | EA | KICK PLATE | 8400 10" X 2" | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | EA | ASTRAGAL | PROVIDED BY DOOR MFGR | | |
| 1 | SET | GASKETING | 188SBK PSA | AA | ZER |
| 2 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 566A | A | ZER |
| 2 | EA | DOOR CONTACT | 679-05 | WHT | SCH |
| 1 | EA | POWER SUPPLY | PS902 900-2RS | LGR | SCH |

Install surface bolts and overhead hold on inactive leaf, closer and exit device on active leaf.

END OF SECTION

SECTION 08 80 00 - GLASS AND GLAZING

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers glass and glazing for windows and doors as indicated on the Drawings and as stipulated herein.

1.2 GENERAL

- A. Except as modified or supplemented herein, all glazing shall be in accordance with the recommendations of the Flat Glass Marketing Association (FGMA).
- B. Tempered glass and laminated glass shall conform to the requirements for glazing materials for Category II products in accordance with the Safety Standard for Architectural Glazing Materials, 16 CFR 1201, as amended.
- C. Insulating glass units shall bear the certification labels of the Insulating Glass Certification Council (IGCC).
- D. Fire rated glass 60 minutes or greater must list fire rating and labeled by UL for fire rating opening as indicated on drawings.

1.3 SUBMITTALS

- A. Complete specifications and data covering the items furnished under this section shall be submitted in accordance with the Submittals Procedures section.

1.4 LABELS

- A. All glass shall be delivered to the work bearing the original manufacturer's labels. These labels shall not be removed until just prior to the final window cleaning.

1.5 COLOR SELECTION

- A. The full range of the manufacturer's standard and custom colors shall be submitted in accordance with the Submittals Procedures section for color selection. A manufacturer provided glazing color chart or samples shall be provided for color selection. Generically printed color charts will not be acceptable.

Glass and Glazing

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to the following:

| | |
|--------------------------|--|
| Exterior Insulated Glass | ASTM E774, Class A; 1 inch thick, made from 1/4 inch PPG "Sungate 500" color series, 1/2 inch air space, and 1/4 inch clear interior lite. |
| Glazing Compound | ASTM C669. |
| Extruded Tape | Pecora "B-44 Extru-Seal", Protective Treatments "PTI 606", or Tremco "440 Tape". |
| Acrylic Sealant | Pecora "Unicrylic" or Tremco "Mono". |
| Setting Blocks | Soft lead or neoprene. |
| Spacers | Cork and rubber; Rhopac "Adhesive Backed Spacer Blocks". |
| Glazing Clips | Spring wire. |

PART 3 - EXECUTION

3.1 GLAZING

A. All glass sizes shall be obtained from measurements of the work at the site or from the manufacturer of the frames in which the glass is to be set. In all cases, however, the Contractor shall be responsible for the correctness of the size of the glass. Locations for each type of glass shall be as indicated or scheduled on the Drawings.

1. Aluminum Window Assemblies.

a. Glass in aluminum window assemblies employing extruded gasket glazing shall be set with the gaskets and stops supplied by the manufacturer of such assemblies and in accordance with the manufacturer's instructions.

3.2 LABELS

A. All glass shall be delivered to the work bearing the original manufacturer's labels. These labels shall not be removed until just prior to the final window cleaning.

Glass and Glazing

3.3 PROTECTION AND CLEANING

- A. All glass shall be protected against breakage during the construction period, and all broken or cracked glass shall be replaced at the time of completion of the work.
- B. All glass shall be cleaned just before final inspection, and all stains and defects shall be removed. Care must be exercised to remove paint, labels, and glazing compound without scratching or marring the surface of the glass or metal work.

End of Section

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Louvers

SECTION 08 90 00 - LOUVERS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the furnishing and installation of stationary type weather louvers, . Combination louver/dampers, control dampers, fire dampers, adjustable louvers, penthouses, and smoke vents are covered in other sections.

1.2 GENERAL

- A. Louvers shall be furnished and installed as specified herein and in accordance with the details, louver schedule, or arrangements indicated on the Drawings.
- B. Louvers shall be of the sizes required for opening sizes indicated on the Drawings. Actual opening sizes for louvers scheduled for insertion within existing construction shall be field verified. Actual louver sizes shall allow for shim and caulk space.

1.3 SUBMITTALS

- A. Complete specifications and detailed drawings covering arrangement, dimensions, hardware, accessories, and details of construction and installation of the louvers shall be submitted in accordance with the Submittals Procedures section.

1.4 COLOR SELECTION

- A. Colors of louvers will be selected from the manufacturer's full line of colors by Engineer. Procedures for selecting colors shall be as indicated in the Submittals Procedures section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.
- B. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damages of any kind. Damaged materials shall be promptly replaced. Materials shall be stored off the ground and protected from the weather.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Governing Standard

1. Except as modified or supplemented herein, all stationary louvers shall be certified to meet the performance criteria specified and outlined by AMCA Standard 500.

B. Finishes

1. Louvers shall have a Kynar paint finish.
2. 70% Kynar paint finishes shall meet the AAMA specification 2605-11 with 1.2 mils total dry film thickness. 50% Kynar paint finishes shall meet the AAMA specification 2604-05 with 1.2 mils (50% Kynar has a much larger standard color selection.)

C. Construction

1. Louvers shall be of aluminum construction and shall be the product of one manufacturer. Louvers shall be furnished complete with all hardware and appurtenances necessary for a satisfactory installation. The louvers shall be welded construction.
2. Stationary type weather louvers shall be architectural style continuous blades with concealed mullions.

D. Performance Requirements

1. Stationary Type

- a. The velocity at which the beginning point of water penetration occurs for stationary type weather louvers shall be at least 790 fpm. The minimum free area for a 48 inches x 48 inches louver shall be 54 percent. The maximum static pressure loss at 600 fpm shall be 0.08 inches wc.

2. Acoustical Type

- a. The velocity at which the beginning point of water penetration occurs for six inch deep acoustical type louvers shall be at least 800 fpm . The minimum free area for a 48 inches x 48 inches louver shall be 25 percent. The maximum static pressure loss at 800 fpm shall be 0.08 inches wc. The minimum noise decibel reduction shall be as follows:

| Octave Band/hz | 1/63 | 2/125 | 3/250 | 4/500 | 5/1000 | 6/2000 | 7/4000 | 8/8000 |
|----------------|------|-------|-------|-------|--------|--------|--------|--------|
| NR, db | 9 | 7 | 8 | 9 | 10 | 16 | 16 | 19 |

Louvers

2.2 ACCEPTABLE PRODUCTS

A. Stationary Type Weather Louvers

1. Subject to the requirements specified herein, stationary type weather louvers shall be equivalent to the following:
Ruskin "ELF-375XH"
Arrow United Industries "EA-410"

B. Accessories

1. Stationary type louvers shall have aluminum removable bird screens.
2. Brick vents shall have aluminum insect screens.

2.3 Materials

| | |
|---------------------|---|
| Aluminum Extrusions | ASTM B221, Alloy 6063-T5, minimum 0.125 inch thick. |
| Bird Screen | 0.051 inch expanded, 0.50 inch flattened bird screen. |

PART 3 - EXECUTION

3.1 GENERAL

- A. Products shall be installed in accordance with this section, the manufacturer's instructions, and as indicated on the Drawings.
- B. Complete specifications and detailed drawings covering arrangement, dimensions, hardware, accessories, and details of construction and installation of the louvers and vents will be made available to the louver and vent installer.

3.2 INSTALLATION

- A. The louvers shall be installed with anchors suitable for the adjacent material and shall be caulked as specified in the caulking section. When required, bird screens or insect screens shall be installed on the louvers.
- B. Where aluminum work is to be attached to steel supporting members or other dissimilar metal, the aluminum shall be kept from direct contact with such metals by a heavy coat of epoxy enamel in accordance with the Architectural Painting section. Aluminum surfaces which will be in contact with concrete or masonry when installed shall be given a heavy coat of epoxy enamel. All paint shall be dry and hard when the coated parts are installed.

End of Section

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SECTION 09 29 00 – GYPSUM WALLBOARD ASSEMBLIES

PART 1 - GENERAL

1-1. SCOPE.

- A. This section covers gypsum wallboard partitions and ceilings, complete with metal furring, framing, and accessories, to be furnished and installed at the locations indicated on the drawings.

1-2. GENERAL.

- A Gypsum wallboard construction shall be coordinated with other building, electrical, heating, ventilating, air conditioning, and plumbing work.

1-3. SUBMITTALS.

- A. Complete specifications, data, and catalog cuts or drawings covering the items furnished under this section, including installation drawings showing ceiling suspension details, shall be submitted in accordance with the Submittals Procedures section.

1-4. DELIVERY AND STORAGE.

- A. All materials shall be delivered in original packages bearing the name of the manufacturer and the brand.
- B. Materials shall be stored inside under cover, with wallboard stacked flat and supported off the floor. Adhesives shall be stored in dry areas and protected against freezing. Metal goods shall be protected against rusting.
- C. Sheet metal and wire gauges set forth herein are minimums and refer to US Standard gauge.

1-5. PROTECTION.

- A. Areas to receive wallboard shall have a temperature of 55 F or higher for 24 hours prior to installation of wallboard. The temperature shall be maintained at 55 F or higher until wallboard installation is complete and joints are completely dry. Adequate ventilation shall be provided to eliminate excessive moisture during and following joint treatment applications.

Gypsum Wallboard Assemblies

PART 2 - PRODUCTS

2-1. MATERIALS. Materials shall conform to the following:

| | |
|---|--|
| Very High-Impact (VHI) Moisture, Mold-Resistant Gypsum Panel | ASTM C1278 and ASTM C1396, 5/8 inch thick, USG Corporation “Sheetrock Brand Glass-Mat Panels Mold Tough VHI Firecode X” with tapered edges. |
| Non-Structural Metal Framing | ASTM C 645; galvanized steel, 20 gauge 6 inch deep channel type screw studs as dimensioned in drawings, complete with top and bottom tracks, including necessary slip tracks for seismic design. |
| Z-Channels | ASTM A924, ASTM A1003; galvanized steel, 20 gauge minimum, 1-1/2-inch depth x 3/4-inch leg x 1-1/4-inch leg, |
| Corner Beads | ASTM C 1047, galvanized steel, one inch by 1-1/4 inch perforated flanges. |
| Casing Beads | ASTM C 1047, galvanized steel, with perforated flanges. |
| Control Joints | |
| Wall | Zinc or galvanized steel, with 1/4 inch wide V-shaped opening and perforated flanges. |
| Joint Compound | ASTM C 475; premixed paste. |
| Joint Tape | ASTM C 475; perforated. |
| Wallboard Screws | ASTM C 1002; Type S, self-tapping screws for 25 gauge metal studs. |
| Wallboard Screws | ASTM C 954; self-tapping screws for 20 gauge metal studs. |
| Powder-Actuated Anchors | ICC AC70 & ASTM E1190. |
| Masonry Nails | Hardened steel, screw type, fabricated from 9 gauge wire. |

PART 3 - EXECUTION

3-1. INSTALLATION OF FRAMING.

- A. Unless otherwise specified, installation of wall framing members shall conform to ASTM C754 and ASCE 7-13.
- B. Framing for Ceiling Drops and Vertical Returns.
 - 1. Ceiling drops and vertical returns shall be constructed as indicated on the drawings and shall be securely anchored to overhead construction. Furring channels shall be spaced at 16 inch centers and shall be rigidly braced and anchored.
- C. Exterior Wall Framing.
 - 1. Tracks shall be aligned accurately according to the partition layout and anchored at 24 inch centers. Studs shall be vertical, spaced not more than 16 inches on center. All studs adjacent to partition intersections and corners shall be anchored to the tracks with screws through each stud and track flange. Stud splices shall be lapped 8 inches and shall have two screws in each flange.
 - 2. Studs shall be located not more than 2 inches from all door frame jambs, partition corners, and dissimilar construction. Studs shall be anchored to the jamb anchor clips of each door frame with bolts or screws. A section of track shall be installed within each door frame head, with the ends slit and the flanges overlapping the adjacent studs and attached with two screws at each end. Stud sections shall be installed over each door frame at the specified spacing.
 - 3. Short lengths of metal studs or wood blocking shall be installed horizontally between studs wherever required for anchorage of wall mounted items at locations indicated on the drawings or as required by the equipment and accessories furnished.
- D. Furring.
 - 1. Furring channels shall be anchored at 16 inch centers. Horizontal furring channels shall be installed at the floor and ceiling line, and as required for proper framing and support. Furring channels shall be plumbed and aligned by shimming.

3-2. INSTALLATION OF GYPSUM WALLBOARD.

- A. Unless otherwise specified, installation shall conform to ASTM C840.
- B. Installation.
 - 1. All wall surfaces shall be very high-impact, water- and mold-resistant gypsum board. General purpose gypsum wallboard shall not be used for this facility.
 - 2. Wallboard shall be of maximum practical length to reduce the number of end joints. Ends and sides shall be in contact but not forced into place. Wallboard shall be cut neatly to fit around all outlets, switch boxes, recessed light fixtures, diffusers, and similar items.
 - 3. For walls and partitions, gypsum wallboard shall be installed with long dimension vertical. All side joints shall be made over framing members. Joints on opposite sides of partitions shall occur over different studs. End joints, if required, shall be neatly fitted and staggered.

Gypsum Wallboard Assemblies

Boards shall be fastened to each framing member with screws spaced not more than 12 inches apart in the field and edges of boards.

C. Attachment.

1. Screws shall be driven not less than 3/8 inch, nor more than 1/2 inch, from ends and edges of boards. All screw heads shall be dimpled slightly below the surface of the board, with particular care taken not to break the face paper or otherwise damage the surface or core of the board.

D Accessories.

1. Metal corner beads shall be installed at all external corners, and metal casing beads shall be installed at all edges of wallboard where exposed or where abutting other materials.
2. In general, all corners and all exposed edges and openings through wallboard shall be protected with metal casings made accurately to size and dimension.

3-3. FINISHING.

- A. Unless otherwise specified, finishing of the gypsum wallboard shall conform to ASTM C840. Where gypsum wallboard is to be painted, all joints, fastener dimples, and other depressions shall be finished with tape and joint compound, with joint compound feathered and sanded smooth. Wallboard surfaces shall be left smooth, clean, and ready for painting or the application of the wall covering.

End of Section

SECTION 09 67 23 – RESINOUS FLOORING

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of seamless floor covering systems, including integral cove bases at the locations specified or indicated on the Drawings.

1-2. GENERAL. All seamless flooring systems provided shall be the product of one manufacturer. The seamless flooring systems shall be furnished complete with all hardware and appurtenances necessary for a complete and satisfactory installation.

1-3. SUBMITTALS. Complete specifications, detailed drawings, color samples, and setting and installation drawings covering seamless flooring shall be submitted in accordance with the Submittals Procedures section. The following additional information shall be required with the submittals:

The manufacturer's printed specifications for application of the flooring.

Data verifying that the applicator has been trained and licensed by the manufacturer of the seamless flooring.

Data verifying that the applicator has not less than 5 years experience in installation of the flooring systems specified.

Listing of installations completed by the applicator in the last 5 years including project name, size, owner contact name and phone number.

1-4. COLOR SELECTION. Color selections will be made by Engineer from the complete line of manufacturer's custom and standard color formulations after the award of contract. The manufacturers standard color shall be provided for locations as indicated on the Drawings.

After the color formulations and patterns have been selected, the following additional samples and data shall be submitted in accordance with the submittal Procedures section:

Two 6 by 6 inch samples of each color pattern of floor covering selected, showing proposed color, aggregate mix, and finish.

1-5. SAMPLE PANEL. Before the installation of any seamless flooring, a 4 foot square sample panel of each color selected shall be prepared at the Site, showing proposed color, finish, and workmanship for seamless flooring. The samples shall include cove bases if required in the finished floor system. All panels required shall consist of seamless flooring placed over a cement board 1/4 inch thick mounted on a rigid framework backing. The seamless flooring shall be applied in accordance with the recommendations of the manufacturer and as specified herein. Installation of seamless flooring shall not begin until Engineer has accepted the sample panels. The panels shall then become the standard of comparison for color, pattern, and finish of the seamless flooring. All required panels shall not be destroyed until the seamless flooring work is completed.

1-6. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

Resinous Flooring

Seamless flooring products shall be protected from damage during transportation, at the Site, and during construction. All containers and packages shall be unopened at delivery and shall contain the name and address of the manufacturer. All metal items shall be protected from rusting. Damaged items will be rejected and shall be replaced.

1-7. WARRANTY. The applicator of the flooring system shall supply, jointly with the flooring system manufacturer, a warranty covering the flooring system materials and installation for a period after installation of 5 years.

PART 2 - PRODUCTS

2-1. FLOORING SYSTEM. The flooring systems shall conform to the following requirements. The flooring system shall be a broadcast system or trowel applied. Other manufacturers will be considered provided all the requirements of these specifications are met.

| | |
|--------------------------|---|
| Flooring System Products | Sikafloor® DecoDur Quartz FX (1/8 inch). Color to be selected by Engineer from manufacturers standard colors. |
|--------------------------|---|

2-2. MATERIALS. All materials shall be blended and packaged in the factory. The addition of water or other loose or foreign matter at the Site will not be permitted.

Materials for the flooring system shall conform to the following:

| | |
|--------------------------------|---|
| Primer | As recommended by the flooring system manufacturer. |
| Topping Matrix and Finish Coat | Thermosetting epoxy resins of formulation recommended by the manufacturer for this installation. Emulsion materials, or those containing wax or styrene, shall not be used. |
| Aggregates | ASTM D451, spherical or angular, translucent quartz grains coated with a pigmented, inorganic ceramic film. |
| Hardness | 6 1/2 - 7 range on Moh's Mineral Scale. |
| Moisture Content | Not to exceed 0.5 percent. |
| Edge and Divider Strips | Extruded aluminum, size and shape as recommended by the manufacturer. |

PART 3 - EXECUTION

3-1. APPLICATION. Seamless flooring shall be applied by experienced, fully trained applicators licensed by the manufacturer of the flooring materials. Applicators shall have not less than 5 years experience in the installation of the types of flooring systems specified. Methods of application shall be in accordance with the recommendations of the manufacturer of the materials and the following requirements:

Resinous Flooring

The base material will be and shall be prepared as specified.

Seamless flooring shall be applied and completed prior to painting and the installation of plumbing fixtures, toilet compartments, cabinetry, appliances, and other objects that may obstruct the application.

3-1.01. Preparation of Surfaces. Concrete slabs shall have a trowel finish as stipulated in the cast-in-place concrete section. Concrete shall be clean and dry and at a surface temperature of at least 55°F when application is started. All contaminants and laitance shall be removed. Existing concrete surfaces shall be abraded as recommended. All bug holes and voids shall be filled and any protrusions ground off. Moisture content of concrete shall be checked by taping a 2 feet square sheet of polyethylene to the floor, covering the film with plywood, and checking for moisture on the underside of the film after 24 hours in accordance with ASTM D4263. Application can be started when no moisture has accumulated on the underside of the film.

All surfaces which are not to receive the flooring system shall be protected by masking or other similar methods.

3-1.02. Priming. Materials, method and rate of application, and the interval between priming and the application of the finish flooring shall be in accordance with the manufacturer's recommendations. Primer shall be uniformly spread and shall not be allowed to collect in surface depressions.

3-1.03. Edge and Divider Strips. Edge strips shall be set at all discontinuous edges of flooring and at all junctures with other flooring materials. Edge strips at doorways shall be centered under the door. Divider strips may be installed at the toe of cove bases and elsewhere if recommended by the manufacturer. Divider strips for pattern changes and dividing large areas of flooring shall be installed as recommended by the flooring manufacturer and where indicated on the Drawings.

Divider strips shall be installed at all structural control or expansion joints. Configuration of the control or expansion joints shall be as recommended by the manufacturer.

3-1.04. Integral Cove Bases. Cove bases at abutting vertical surfaces such as walls and curbs shall consist of a 1 inch radius cove formed of a mixture of epoxy and flint shot silica sand to be built up and overlaid with the finish flooring material. The cove base height shall be , and shall be uniform, straight, and true. Top edges of cove bases shall be finished with a slight radius to the wall, unless otherwise indicated or detailed on the Drawings.

3-1.05. Finish Flooring. Epoxy binder and aggregates shall be mixed to match the accepted standard sample. Adjacent surfaces shall be masked or protected as needed. Flooring materials shall be machine mixed and trowel-applied or broadcasting of aggregates in accordance with the manufacturer's instructions. The surface shall be tightly compacted and free from holes, depressions, and trowel marks.

The finish coat shall be applied in accordance with the manufacturer's recommendations and shall produce a uniform satin finish over the entire floor area. Surfaces shall be inspected for irregular or lumpy areas prior to application of the finish coat. All irregular, uneven, and misaligned floor, curb, and base surfaces shall be repaired as recommended by the flooring manufacturer and to the satisfaction of Engineer prior to finish coat application. The minimum installed thickness shall be 1/4 inch.

Resinous Flooring

3-2. THICKNESS VERIFICATION. If requested by Engineer, prior to the application of the finish coat, Contractor shall take a minimum of four 1 inch diameter core samples through the flooring system into the substrate to verify proper system thickness. Cored areas found to have less than the specified thickness shall be removed and replaced and additional core samples may be taken as necessary to verify the thickness of the entire floor area. Core holes shall be filled in with floor material to match the surrounding floor elevation prior to application of the seal coat.

3-3. ACCEPTANCE. The finished floor system may be rejected for any of the following reasons:

Uneven or patchy color and inconsistency in the color granular mix.

Uneven application of the seal coat or uneven application of the slip resistant coatings.

Variations in flooring system thickness.

Cracking, discoloration, blisters, unusual roughness of the floor system; or separation of the flooring system from the subbase.

3-4. PROTECTION AND FINAL CLEANING. Seamless floor covering shall be protected from damage until acceptance by Owner. Areas that are subject to traffic or over which materials or equipment are to be moved shall be temporarily covered with durable nonstaining paper, such as St. Regis "Seekure", or otherwise adequately protected.

Just before final acceptance, seamless floor covering shall be mopped clean with water and mild detergent, rinsed, and dried.

End of Section

SECTION 09 92 00 – ARCHITECTURAL PAINTING

PART 1 - GENERAL

1-1. SCOPE. This section covers architectural field painting of surfaces for appearance, including surface preparation, protection of surfaces, and other appurtenant work. Regardless of the number of coats previously applied, at least two field coats, in addition to any shop or field prime coats, shall be applied to all surfaces unless otherwise specified.

Dampproofing of concrete surfaces not in contact with treated or raw water, water repellent for masonry surfaces, elastomeric deck coverings, protective coatings for equipment, and surfaces with severe service conditions that have been designated to be coated with a heavy-duty maintenance coating, are covered in other sections.

See Protective Coatings section, for painting of equipment and surfaces designated to be coated with heavy-duty maintenance coatings.

1-2. GENERAL. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this Specification and the coating manufacturer's recommendations.

1-2.01. Governing Standards.

All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following: American Water Works Association (AWWA), American National Standard Institute (ANSI), NACE International (NACE), The Society for Protective Coating (SSPC), NSF International (NSF), and ASTM requirements.

1-3. SUBMITTALS. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications and the completed Coating System Data Sheets, to Engineer for review and color selection. Requests for review submitted directly to Engineer by coating suppliers will not be considered.

For the epoxy enamel, aliphatic polyurethane, and satin gloss latex emulsion finish coatings, a total of not more than five custom colors (excluding deep tone or high-level colors) may be required. The manufacturer's standard colors will be acceptable for all other coatings.

1-4. QUALITY ASSURANCE.

1-4.01. Coating System Data Sheet Certifications.

When required, the coating applicator and coating manufacturer shall review and approve in writing the proposed coating manufacturer's written recommendations for the proposed coating system and the intended service. Any variations from the Specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer. The coating manufacturer shall observe the surface preparation, mixing, and application of the protective coating systems and submit a written report of what has been observed and any additional recommendations.

1-5. DELIVERY AND STORAGE. All coating products shall be received and stored in accordance with the coating manufacturer's recommendations.

PART 2 - PRODUCTS

2-1. ACCEPTABLE MANUFACTURERS.

2-1.01. Alternative Manufacturers.

In addition to the coatings listed herein, equivalent coatings of the following manufacturers will also be acceptable:

| | |
|---------------|------------------|
| ICI Devoe | Rust-Oleum |
| MAB | Sherwin-Williams |
| Diamond Vogel | |

2-1.02. Equivalent Coatings.

Whenever a coating is specified by the name of a proprietary product or of a particular manufacturer or vendor, the specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' coatings will be accepted, provided that sufficient information is submitted to enable Engineer to determine that the proposed coatings are equivalent to those named. Information on proposed coatings shall be submitted for review in accordance with Submittals Procedures section. Requests for review of equivalency will be accepted only from Contractor and will be considered only after the Contract has been awarded.

2-2. MATERIALS. All coatings shall be delivered to the job in original unopened containers with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.

All coatings shall conform to the air quality regulations applicable at the location of use. Coating materials which cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.

Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with the coatings on shop coated or previously coated surfaces. Coatings used in successive field coats shall be produced by the same manufacturer. Coatings used in the first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats. Costs for additional primer coats applied over shop prime coatings shall be borne by the Contractor.

2-2.01. Primers.

| | |
|------------------|--|
| Universal Primer | PPG "Amercoat 385 Epoxy", Carboline "Carboguard 888 Primer", or Themec "Series N27 S.T. Typoxy". |
|------------------|--|

2-2.02. Intermediate and Finish Coatings.

Epoxy Enamel

Ferrous Metal Surfaces,

PPG “Amercoat 385 Epoxy”,
Carboline “Carboguard 890”, or Tnemec “Series 69
Hi-Build Epoxoline II”.

Aliphatic Polyurethane

PPG “Amercoat 450 H Aliphatic Polyurethane”,
Carboline “Carbothane 134HG”, or Tnemec
“Series 74 Endura-Shield”.

Latex Emulsion Acrylic containing at least 50 percent by weight nonvolatile solids.

Flat

Carboline “Carbocrylic 600”, Sherwin-Williams
“Weather Perfect Acrylic Latex Series B-36”, or
Tnemec “Series 6 Tneme-Cryl”.

Satin Gloss

PPG “Amercoat 220 Acrylic Enamel Satin”,
Carboline “Carbocrylic 3350”, Sherwin-Williams
“Metalatex Semi-Gloss Enamel Series B-42”, or
Tnemec “Series 7 Tneme-Cryl SG”.

Interior Alkyd, Satin

Sherwin Williams “ProClassic”, Interior Alkyd
Satin, B33W220 Series

Traffic Marking Paint

Fed Spec TT-P-115, white; ICI Devco “Glidden
Traffic Marking Paint 667355” or Sherwin-Williams
“ProMar Alkyd Traffic Marking Paint”.

PART 3 - EXECUTION

3-1. SURFACE PREPARATION. All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss of previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.

Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic.

When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer and the edges shall be sanded or wire brushed and feathered or otherwise smoothed so that they will not be noticeable after they are coated. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.

3-1.01. Galvanized Surfaces.

Galvanized surfaces shall be prepared for coating in conformity with the instructions of the manufacturer of the epoxy enamel. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.

3-1.02. Ferrous Metal Surfaces-Non-immersion Service.

Ferrous metal surfaces, including fabricated equipment, in non-immersion service shall be cleaned to the degree recommended by the coating manufacturer for surfaces to be coated with epoxy enamel, except galvanized surfaces. Blast cleaning to at least SSPC-SP6 shall be used where recommended by the coating manufacturer, and may be used elsewhere at the option of Contractor, provided that no dust is permitted to settle on adjacent wet coating. Surface profile shall be at least 15 percent of the dry film thickness specified for the coating system.

3-1.03. Hardware.

Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

3-2. MIXING AND THINNING. Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.

Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3-3. APPLICATION. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be thoroughly dry and hard before the next coat is applied. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.

Coating failures will not be accepted and shall be entirely removed and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, or delaminations.

3-3.01. Priming.

Edges, corners, crevices, welds, and bolts shall be given a brush coat of primer before application of the primer coat. Special attention shall be given to filling all crevices with coating.

Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the spot or touchup coating, shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.

3-3.02. Latex Coating.

Latex coating shall be applied by brushing or rolling; spraying will not be permitted. Latex coating shall not be thinned excessively.

3-3.03. Epoxy Enamel.

Epoxy enamel shall be applied in accordance with the coating manufacturer's recommendations, including temperature limitations and protection from sunlight until topcoated.

Coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4 to 6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

3-3.04. Film Thickness. The total coating film thickness, including prime coat (if any), intermediate coats, and finish coat, shall be not less than the following:

| Type of Coating | Minimum Dry Film Thickness |
|---|-----------------------------------|
| Latex | 3 mils |
| Epoxy enamel | |
| Surfaces with first coat of epoxy enamel and final coat of aliphatic polyurethane | 7 mils |
| Other surfaces (two coats) | 10 mils |
| All other finishes | 5 mils |

3-3.05. Weather Conditions. Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating. Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

3-4. REPAIRING FACTORY-FINISHED SURFACES. Factory-finished surfaces damaged prior to acceptance by Owner shall be spot primed and recoated with materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.

3-5. PROTECTION OF SURFACES. Throughout the Work, Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors' operations. Coatings spilled or spattered on adjacent surfaces which are not being coated at the time shall be immediately removed.

Exposed concrete or masonry not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by Owner, coated with two coats of masonry coating.

3-6. FIELD PRIMING SCHEDULE. In general, surfaces of steel, cast iron, and equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field primed. Galvanized, aluminum, stainless steel, wood, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be as follows:

| Surface To Be Primed | Material |
|---|---|
| Steel and cast iron, surfaces to be coated with | |
| Epoxy enamel | Same as finish coats. |
| Galvanized | Epoxy enamel. |
| Aluminum | As recommended by manufacturer of finish coats. |
| Plastic surfaces, including PVC and FRP | Same as finish coats. |
| Insulated piping | As recommended by manufacturer of finish coats. |

Unless otherwise recommended by the coating manufacturer or specified herein, priming will not be required on concrete or gypsum wallboard surfaces specified to be coated with latex coating, nor on metal surfaces specified to be coated with epoxy enamel coatings. Priming will not be required on surfaces to be marked with traffic marking paint.

3-7. COATING SCHEDULE. The following schedule lists coatings for intermediate and finish coats. All exposed surfaces, including sides and edges, shall be coated.

3-7.01. Metal Surfaces.

| Surface To Be Coated | Material |
|---|---------------------------------|
| Structural and miscellaneous steel exposed to view inside buildings. | Epoxy enamel (one finish coat). |
| Unless otherwise specified, steel doors, door frames, and steel handrails | |
| Intermediate coat. | Universal primer |
| Finish coat. | Aliphatic polyurethane, satin |

| Surface To Be Coated | Material |
|---|------------------------|
| Heating and air conditioning units, convactor covers, electrical equipment cabinets, and similar items and equipment (unless factory finished) exposed to view. | |
| Intermediate coat. | Universal primer |
| Finish coat. | Aliphatic polyurethane |
| Ductwork exposed to view inside buildings, after proper priming. | |
| Adjacent to ceilings. | Aliphatic polyurethane |
| Adjacent to walls. | Aliphatic polyurethane |
| Electrical conduit exposed to view inside buildings (except banks of conduits in multiple layers hung from ceilings), including fittings, boxes, supports, and accessories, after proper priming. | |
| Adjacent to ceilings. | Aliphatic polyurethane |
| Adjacent to walls. | Aliphatic polyurethane |
| 3-7.02. Miscellaneous Surfaces. | |
| Gypsum wallboard (two coats). | |
| Walls. | |
| Intermediate coat. | Universal primer |
| Finish coat. | Epoxy enamel. |
| Insulated piping (except aluminum jacketed insulation). | Aliphatic polyurethane |
| Plastic surfaces, including PVC and FRP. | |
| Indoors. | Epoxy enamel. |

Outdoors.

First coat. Epoxy enamel.

Finish coat. Aliphatic polyurethane

Fasteners in solid vinyl trim As recommended by the manufacturer

3-7.03. Surfaces Not to Be Coated. Unless otherwise specified, the following surfaces shall be left uncoated:

1. Exposed aluminum, except ductwork.
2. Polished or finished stainless steel. Unfinished stainless steel, except flashings and counterflashings, shall be coated.
3. Nickel or chromium.

Piping concealed in inaccessible plumbing chases and above suspended ceilings.

1. Rubber and plastics, except as specified.
2. Acoustical panel ceilings.
3. Portland cement plaster.
4. Exterior concrete, unless noted otherwise.
5. Surfaces specified to be factory finished.

End of Section

Protective Coatings

Section 09 96 11 - PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers field applied protective coatings, including surface preparation, protection of surfaces, inspection, and other appurtenant work for equipment and surfaces designated to be coated with heavy-duty maintenance coatings. Regardless of the number of coats previously applied, at least two field coats in addition to any shop coats or field prime coats shall be applied to all surfaces unless otherwise specified.

1.2 GENERAL

- A. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this Specification and the coating manufacturer's recommendations.
- B. Governing Standards
 - 1. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following AWWA, ANSI, NACE, SSPC, NSF, and ASTM.
- C. Delivery and Storage
 - 1. All coating products shall be received and stored in accordance with the coating manufacturer's recommendations.
- D. Coatings, Painting, and Linings Covered in Other Sections
 - 1. Architectural painting.
 - 2. Dampproofing of concrete when NSF compliance is not required.
 - 3. Corrosion protection lining systems for secondary containment.
 - 4. Elastomeric high solids urethane lining systems for corrosion protection and waterproofing.
 - 5. Elastomeric deck covering.

Protective Coatings

1.3 SUBMITTALS

A. General Submittals and Data

1. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications, manufacturer's product data sheet and the completed Coating System Data Sheets, to Engineer for review and color selection. Each product data sheet shall include application temperature limits including recoat time requirements for the ambient conditions at the site, including temperatures up to 130° F. Requests for review submitted directly to Engineer by coating suppliers will not be considered.

B. Data Sheets

1. Contractor shall submit a Coating System Data Sheet for each separately identified surface in the Metal Surfaces Coating Schedule, Concrete and Masonry Surfaces Coating Schedule, and the Miscellaneous Surfaces Coating Schedule that will be used in the Project, using the appropriate Coating System Data Sheet forms (Figures 1-[09940][09 96 11] and 2-09 96 11) at the end of this section. Each field coating system shall be acceptable to the coating material manufacturer.

- a. Coating System Data Sheets shall be assigned a unique number with a prefix letter based on the following:

| Prefix | Surfaces | Fig. 09 96 11 |
|--------|---|---------------|
| A | Iron and steel (coated entirely in field) | 1 |
| A | Iron and steel (shop primed) | 2 |
| C | Concrete and concrete block | 1 |
| G | Galvanized | 1 |

- b. Each coating system that will be applied entirely in the field shall be assigned only a prefix letter and no suffix letter. Fig 1-09 96 11 shall be submitted for each surface coated entirely in the field.
- c. Each shop-applied coating system that includes one or more field applied coats shall be assigned both a prefix letter and suffix letter "F." Fig 2-09 96 11 shall be submitted for each surface having a shop applied coating and one or more field applied finish coats.
- d. A separate Coating System Data Sheet shall be developed and submitted for each surface scheduled to be coated or variation or change in a coating system. The number identifying the surface and coating system shall be of the form A1₁ or A1₂-F. The subscript number shall be assigned by the Contractor so that each surface and coating system combination is uniquely identified. For example:
 - 1) A1₁-F may be assigned to "Epoxy – one coat to metal curbs for skylights and power roof ventilators that have been shop primed."
 - 2) A2₁ may be assigned to "Epoxy – two coats to non-galvanized structural and miscellaneous steel exposed to view inside buildings."
 - 3) C2₁ may be assigned to "Epoxy – two coats to all concrete and concrete block in corrosive area (Except floors and surfaces scheduled to receive other coatings) which are exposed to view."

Protective Coatings

- 4) C2₂ may be assigned to “Epoxy – two coats to walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment as indicated on the Drawings.”

C. Color Submittals

1. For the epoxy and for aliphatic polyurethane, a total of not more than 15 custom colors (excluding deeptone or highlevel colors) may be required. The manufacturer’s standard colors will be acceptable for all other coatings.
2. The manufacturer’s standard colors will be acceptable for all coatings.

1.4 QUALITY ASSURANCE

A. Coating System Data Sheet Certifications

1. The coating applicator and coating manufacturer shall review and approve in writing the coating manufacturer’s written recommendations for the coating system and the intended service. Any variations from the Specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer.
2. The coating manufacturer shall observe the surface preparation, mixing, and application of the coating systems and submit a written report of his observations and any additional recommendations.

B. Special Interior Coating Systems

1. The coating system for Insert location shall be Insert coating system.
2. In addition to the requirements for all coating systems, the coating applicator and coating manufacturer shall develop and submit, in writing, the proposed detailed procedures for handling, storing, surface preparation, mixing, and application to verify compliance with this Specification and the coating manufacturer’s written recommendations. The procedures shall include copies of the coating manufacturer’s published recommendations and the proposed method for complying with these recommendations and these Specifications. Contractor, coating applicator, and coating manufacturer shall review and approve, in writing, the proposed detail procedures before they are submitted for review.
3. Contractor and coating manufacturer shall inspect coating application of the appropriate application methods.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Alternative Manufacturers

Protective Coatings

1. In addition to the coatings listed herein, equivalent products of other manufacturers that distribute globally will also be acceptable.

B. Equivalent Coatings

1. Whenever a coating is specified by the name of a proprietary product or of a particular manufacturer or vendor, it shall be understood as establishing the desired type and quality of coating. Other manufacturers' coatings will be accepted, provided that sufficient information is submitted to enable Engineer to determine that the proposed coatings are equivalent to those named. Information on proposed coatings shall be submitted for review in accordance with the Submittals Procedures section. Requests for review of equivalency will be accepted only from Contractor and will be considered only after the contract has been awarded.

2.2 MATERIALS

- A. All coatings shall be delivered to the job in original, unopened containers, with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.
- B. All coatings shall conform to the air quality regulations applicable at the location of use. Coating materials that cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.
- C. With the exception of heat resistant coatings, the coatings specified have been selected on the basis of the manufacturer's statement that the VOC content of the product is 2.8 lbs per gallon or less; however, it shall be the Contractor's responsibility to use only coating materials that are in compliance with the requirements of all regulatory agencies. Local regulations may require some coatings to have a lower VOC content than specified herein. The coatings specified may meet the VOC limits in the unthinned (as shipped) condition but may exceed the limits if thinned according to the manufacturer's recommendations. In such case, the coatings shall not be thinned beyond the 2.8 lbs per gallon limit, and if the product cannot be thinned to suit the application method or temperature limits, another manufacturer's coating shall be used, subject to acceptance by Engineer's coating shall be used, subject to acceptance by Engineer.
- D. Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with any previously applied coatings. Coatings used in successive field coats shall be produced by the same manufacturer. The first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats.
- E. All coatings used on surfaces that will be in contact with potable or treated water shall be certified as being in compliance with ANSI/NSF 61. Coatings that cannot be so certified, whether or not specified by manufacturer and by product designation, shall not be used.
- F. All intermediate and finish coating materials that will be in contact with wastewater atmosphere shall be guaranteed by the manufacturer to be fume proof and suitable for wastewater plant atmosphere that contains hydrogen sulfide. Coatings that cannot be so guaranteed shall not be used. Leadfree, chromium-free, and mercury free coatings shall be used.

Protective Coatings

G. Primers

Universal Primer (tie coat) PPG “Amerlock Sealer,” Carboline “Rustbond Series,” International Devoe “Devran 201H,” Tnemec “Series 27 F.C. Typoxy,” or Sherwin-Williams “Dura Plate 235.”

Zinc Primer PPG “Dimetate 9 Series,” Carboline “Carbo Zinc II Series,” International Devoe “Catha-Coat 302H,” Tnemec «Series 90-97 Zinc Primer », or Sherwin-Williams “Zinc Clad II Series.”

H. Fillers and Surfacer

Epoxy Concrete Block Filler PPG “Amerlock 400BF Epoxy Block Filler,” Carboline “Sanitile 600,” International Devoe “Devron 224V,” Tnemec “ Series 130 Envirofill ,” or Sherwin-Williams “ ”

Epoxy Concrete Filler and Surfacer Tnemec “Series 218 MortarClad,” PPG Amercoat “ 114A,” Carboline “Carboguard 510,” or Sherwin-Williams “Steel Seam FT910.”

I. Intermediate and Finish Coatings

Epoxy (NSF certified systems)

Ferrous Metal Surfaces and Concrete Surfaces in Contact with Treated or Raw Water in Potable Water Facilities PPG “Amerlock 400 High-Solids Epoxy Coating,” Carboline “Carboguard 891 VOC,” International Devoe “Bar-Rust 233H” Tnemec “Series N140 Pota-Pox Plus,” or Sherwin-Williams “Dura Plate 235 NSF”; immersion service.

Epoxy

Concrete Floors PPG “Amerlock 2/400,” Carboline “Carboguard 890,” International Devoe “Devran 224V,” Tnemec “Series N69 Hi-Build Epoxoline II,” or Sherwin-Williams “Armorseal 1000HS”; nonskid.

Ferrous Metal Surfaces and Masonry or Concrete Surfaces Other Than Floors PPG “Amercoat 385 Epoxy,” Carboline “Carboguard 890,” International Devoe Devran “224V,” Tnemec “Series N69 Hi-Build Epoxoline II,” or Sherwin-Williams “Dura Plate 235.”

Flake-Filled Epoxy PPG Novaguard 890 FF, Carboline “Plasite 4500/4500S,” Sherwin-Williams “Sher-Glass FF,” Tnemec “Series 142 Epoxoline.” or International “Interzone 954GF”.

Aliphatic Polyurethane PPG “Pitthane Ultra,” Carboline “Carbothane 134HG,” International “Intervane 990V” Tnemec “Series 1074 Endura-Shield II,” or Sherwin-Williams “Acrolon 218HS.”

Protective Coatings

| | |
|---|--|
| Coal Tar Epoxy/ High-build coal tar epoxy | PPG Amercoat “78HB Coal Tar Epoxy,” Carboline “Bitumastic 300 M,” Tnemec “46H-413 Hi-Build Tneme-Tar,” International “Interzone 954 Black” or Sherwin-Williams “Targuard Coal Tar Epoxy” |
| Medium Consistency Coal Tar | PPG Amercoat 240 Black, Carboline “Bitumastic 50” International “Devoe Bar-Rust 236 Black” or Tnemec “46-465 H.B. Tnemecol.” |
| Vinyl Ester | Tnemec “Series 120 Vinester” Carboline “Plasite 4110” or Sherwin-Williams “Magnalux 304FF.” International Paint «Ceilcote 232 Flakeline » |
| Heat-Resistant (Suitable for temperatures up to 400° F [207° C]) | PPG “Hi Temp 500,” Carboline “Thermaline 450,” Tnemec “43-36 Chrome Aluminum,” International “Interbond 2340UPC” or Sherwin-Williams “Heat-Flex Hi-Temp 500.” |
| High Heat-Resistant (Suitable for temperatures up to 1000° F [537° C]) | PPG “Hi Temp 1000,” Carboline “Thermaline 4700 VOC,” or Sherwin-Williams “Heat-Flex Hi-Temp 1000.” |
| Acrylic Latex Emulsion (Flat) | PPG “Pitt Tech Series,” Carboline “Carbocrylic 3359,” International “Intercryl 520 Waterborne Acrylic” or Tnemec “Series 1026 Enduratone”. |
| Acrylic Latex Emulsion (semi-gloss) | PPG “Pitt Tech Series,” Carboline “Carbocrylic 3359,” Sherwin-Williams “SherCryl HPA Semi-Gloss,” or Tnemec “Series 1029 Enduratone”. |
| Acrylic Latex Emulsion (Gloss) | PPG “Pitt Tech Series,” Carboline “Carbocrylic 3359,” Sherwin-Williams “SherCryl HPA Gloss,” International “Intercryl 530 Waterborne Acrylic” or Tnemec “Series 1028 Enduratone”. |

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss on previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.
- B. Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic.

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- C. When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer, and the edges of the repaired area shall be feathered by sanding or wire brushing to produce a smooth transition that will not be noticeable after the coating is applied. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.
- D. Galvanized Surfaces
1. When a coating is required, galvanized surfaces shall be prepared for coating according to the instructions of the manufacturer of the epoxy. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.
- E. Concrete Surfaces
1. All concrete surfaces shall be free of objectionable substances and shall meet the coating manufacturer's recommendations for surface preparation. Concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE 6. Any other surface preparation recommended by the coating material manufacturer shall be brought to Engineer's attention and may be incorporated into the work if acceptable to Engineer.
 2. All concrete surfaces shall be dry when coated and free from dirt, dust, sand, mud, oil, grease, and other objectionable substances. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started.
 3. New concrete shall have sufficiently cured for at least 4 weeks or reached moisture content levels at or below the material manufacturer's requirements before coating is applied. Concrete surfaces shall be tested for capillary moisture in accordance with ASTM D4263. There shall be no capillary moisture when coatings are applied on concrete.
 4. All surfaces to be coated shall be cleaned and prepared in accordance with the printed manufacturer's requirements or ASTM D4258 and abraded in accordance with ASTM D4259. Surface profile shall be at least 25 percent of the dry film thickness specified for the coating system. Prior to application of the coating, the surfaces shall be thoroughly washed or cleaned by air blasting to remove all dust and residue. Spalled areas, voids, and cracks shall be repaired in accordance with the Concrete section and as acceptable to the Engineer. Fins and other surface projections shall be removed to provide a flush surface before application of coating.
 5. Except where epoxy is applied as damp-proofing, the concrete surfaces, including those with bug holes less than 1 inch in any dimension, shall be prepared as recommended by the manufacturer, using an epoxy concrete filler and surfacer. Where coating with a vinyl ester the concrete filler and surfacer shall be as recommended by the manufacturer to be compatible with vinyl ester.
- F. Hardware
1. Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

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3.2 Other Existing Coated Surfaces. Other existing coated surfaces which are indicated on the drawings to be recoated shall be prepared in accordance with the coating manufacturer's recommendations.

3.3 MIXING AND THINNING

- A. Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.
- B. Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3.4 APPLICATION

- A. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be thoroughly dry and hard before the next coat is applied. Each coat shall be a different color, if available. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.
- B. Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.
- C. Priming
 - 1. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of primer before application of the primer coat. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating. When using zinc primers the stripe coat shall follow the initial prime coat.
 - 2. Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the spot or touchup coating shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.
- D. Epoxy
 - 1. When used, epoxy shall be applied in accordance with the coating manufacturer's recommendations, including temperature limitations and protection from sunlight until top-coated.

Protective Coatings

2. When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.
3. When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4-6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

E. Film Thickness

1. The total coating film thickness including intermediate coats and finish coat, shall be not less than the following:

| Type of Coating | Minimum Dry Film Thickness |
|--|--|
| Medium consistency coal tar | 20 mils . |
| Coal tar epoxy (two coats) | 20 mils . |
| Epoxy | |
| Floors (two coats) | 10 mils . |
| Surfaces with first coat of epoxy and final coat of aliphatic polyurethane | 7 mils (5 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane). |
| Surfaces with first and second coat of epoxy and final coat of aliphatic polyurethane | 12 mils (10 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane). |
| Other surfaces (two coats) | 10 mils . |
| Immersion service (three coats) | 15 mils . |
| Flake-filled epoxy (two coats) | 30 mils . |
| Vinyl ester | 30 mils . |
| Zinc, epoxy, polyurethane | |
| Surfaces with first coat of zinc, intermediate coat of epoxy, and final coat of aliphatic polyurethane | 10 mils , 3 mils zinc, 5 mils epoxy, plus 2 mils for aliphatic polyurethane. |
| Heat-resistant (silicone) | 3 mils . |
| High heat-resistant (silicone) | 3 mils . |
| Other (one coat) | 5 mils . |
| Other (two coats) | 10 mils . |

F. Weather Conditions

1. Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating.

Protective Coatings

2. Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer, or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.
3. Coatings shall not be applied at temperatures higher than the maximum temperature recommended by the coating manufacturer. Where coatings are applied during periods of elevated ambient temperatures, Contractor and the coatings manufacturer shall be jointly responsible to ensure that proper application is performed including adherence to all re-coat window requirements. Precautions shall be taken to reduce the temperature of the surface application, especially for metal, at elevated temperatures above 100° F including shading application area from direct sunlight, applying coating in the evening or at night, and ventilating the area to reduce the humidity and temperature,
4. Vinyl ester coating materials, when required, shall be maintained during transportation, storage, mixing, and application at the temperature required by the coating manufacturer, 35° F to 90° F .

3.5 REPAIRING FACTORY FINISHED SURFACES

- A. Factory finished surfaces damaged prior to acceptance by Owner shall be spot primed and recoated with materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.

3.6 PROTECTION OF SURFACES

- A. Throughout the work Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors' operations. Coatings spilled or splattered on adjacent surfaces which are not being coated at the time shall be immediately removed. Exposed concrete or masonry not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by Owner, coated with two coats of masonry coating.

3.7 FIELD QUALITY CONTROL

- A. The following inspection and testing shall be performed: surface profile, visual inspection, [spark testing,][adhesion testing,] and wet and dry film thickness testing. All inspection and testing shall be witnessed by Engineer.
- B. Surface Profile Testing
 1. The surface profile for ferrous metal surfaces shall be measured for compliance with the specified minimum profile. The surface profile for concrete shall comply with SSPC 13/NACE 6 Table 1 for severe service.
- C. Visual Inspection

Protective Coatings

1. The surface of the protective coatings shall be visually inspected.

D. Film Thickness

1. Coating film thickness shall be verified by measuring the film thickness of each coat as it is applied and the dry film thickness of the entire system. Wet film thickness shall be measured with a gauge that will measure the wet film thickness within an accuracy of ± 0.5 mil. Dry film thickness shall be measured in accordance with SSPC-PA 2.

E. Spark Testing

1. Coatings shall be spark tested by the coating manufacturer using an acceptable electrical spark tester set at the recommended voltage. Engineer shall observe the spark testing and shall verify the testing equipment is working properly before the spark testing of the coating is started. The electrode movement shall be continuous and shall proceed in a systematic manner that will cover 110 percent of the coated surface.
2. Spark testing for coatings on metal shall be done in accordance with ASTM D5162. Spark testing for coating on concrete shall be done in accordance with ASTM D4787.
3. All detected holidays and pinholes shall be marked and repaired as recommended by the coating material manufacturer.

F. Adhesion Testing

1. An adhesion test shall be conducted on properly prepared and coated steel or concrete surface that is acceptable to the coating material manufacturer and Engineer. The test area shall be at least 2 square feet [0.2 m^2] or larger to allow a minimum of three tests to be conducted. The test area shall then be coated with the specified system and cured as recommended by the coating material manufacturer.
2. At the Engineer/Owner's discretion, pull-off strength adhesion tests of the coating shall be conducted by the coating material manufacturer in accordance with ASTM D4541 for metal surfaces and ASTM D7234 for concrete surfaces. Elcometer or other tensile adhesion tester acceptable to the Engineer shall be used. At least three adhesion tests shall be conducted and the results averaged. Adhesion strength shall equal or exceed the minimum adhesion strength recommended by the coating material manufacturer and shall exceed the tensile strength of the concrete.
3. If the coating fails the adhesion test, the cause of the failure shall be determined and corrected before reconducting the test.

3.8 FIELD PRIMING SCHEDULE

- A. In general, steel and cast iron surfaces of equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field coated, including prime coat (if any). Galvanized, aluminum, stainless steel, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be:

Protective Coatings

| <u>Surface To Be Primed</u> | <u>Material</u> |
|---|---|
| Equipment, surfaces to be coated with | |
| Aliphatic polyurethane | Universal primer. |
| Epoxy | Same as finish coats. |
| Steel and cast iron, surfaces to be coated with | |
| Epoxy | Same as finish coats or inorganic zinc. |
| Galvanized | Epoxy. |
| Concrete, surfaces to be coated with epoxy | |
| For damp-proofing | Epoxy. |
| For all other surfaces | Epoxy concrete filler and surfacer. |

- B. Unless otherwise recommended by the coating manufacturer or specified herein, priming will not be required on concrete, or concrete block, nor on metal surfaces specified to be coated with coal tar epoxy, and heat-resistant coatings. Concrete surfaces to be coated with epoxy shall be filled with epoxy concrete filler and surfacer so that a continuous film is obtained, except where concrete is damp-proofed with epoxy.

3.9 FINISH COATING SYSTEMS

- A. The following schedule lists coatings systems and coating surface designations. See Article 1-3 for a definition of the surface designations.

| No. | Finish Coating Systems | Coating Surface Designation | | | | | | |
|-----|---|-----------------------------|---|---|---|---|---|---|
| | | A | C | E | F | G | H | P |
| 1. | Epoxy – One coat | x | | | x | x | | |
| 2. | Epoxy – Two coats | x | x | x | x | x | | x |
| 3. | Epoxy / NSF – Two coats | | x | x | | | | |
| 4. | Epoxy – Three coats | x | x | x | | | | |
| 5. | Epoxy / NSF – Three coats | x | x | x | | | | |
| 6. | Epoxy – First coat Aliphatic polyurethane – Finish coat | x | x | x | x | x | | x |
| 7. | Epoxy – First and second coat Aliphatic polyurethane – Finish coat | x | x | x | x | x | | |
| 8. | Universal primer – First coat Aliphatic polyurethane – Finish coat | x | | x | | | | |
| 9. | Medium consistency coal tar – Two coats | x | x | x | | | | |
| 10. | Coal tar epoxy – Two coats | x | x | x | | | | |
| 11. | Vinyl ester – Two coats | x | x | x | | | | |

Protective Coatings

| No. | Finish Coating Systems | Coating Surface Designation | | | | | | |
|-----|--|-----------------------------|---|---|---|---|---|---|
| | | A | C | E | F | G | H | P |
| 12. | Heat resistant – Two coats | | | | | | x | |
| 13. | High heat resistant – Two coats | | | | | | x | |
| 14. | Zinc primer – First coat Epoxy – Intermediate coat Aliphatic polyurethane – Final coat | x | | x | | | | |
| 15. | Flake-filled epoxy | x | | x | | | | |
| 16. | Acrylic Latex Emulsion | | x | | | | | x |

B. Surfaces Not To Be Coated

1. Unless otherwise specified, the following surfaces shall be left uncoated:
 - a. Exposed aluminum, except ductwork.
 - b. Polished or finished stainless steel. Unfinished stainless steel, except flashings and counter flashings, shall be coated.
 - c. Nickel or chromium.
 - d. Galvanized surfaces, except piping, conduit, ductwork, and other items specifically noted. Hot dipped galvanized fabrications, including fabricated pipe supports, except where specifically noted. Rubber and plastics, except as specified.
 - e. Exterior concrete.
 - f. FRP wastewater troughs.
 - g. Surfaces specified to be factory finished.

C. Shop Finishing

1. Items to be shop finished including the following. Shop finishing shall be in accordance with the coating manufacturer's recommendations.
 - a. All slide gates.
 - b. All conveyors.
 - c. Other surfaces where blast cleaning cannot be or is not recommended to be performed in the field.
 - d. Other items as otherwise specified.

D. Field Coating

1. Items to be field coated include the following. Field coating shall be in accordance with the field priming schedule, the coating schedule, and the manufacturer's recommendations.
 - a. Exterior surface of the sludge hopper.
 - b. Surfaces not indicated to be shop finished and surfaces where blast cleaning can be performed in the field.
 - c. All interior ferrous metal surfaces except stainless steel on the digester cover.
 - d. Other items as otherwise specified.

Protective Coatings

3.10 METAL SURFACES COATING SCHEDULE

Surfaces to be coated shall include new work, including Owner furnished equipment and surfaces disturbed by the Work. Surfaces that are not disturbed will not require recoating unless noted otherwise on the Drawings.

| <u>Surface To Be Coated</u> | <u>Finish Coating System</u> |
|---|---|
| [Non-galvanized [and galvanized] structural and miscellaneous steel exposed to view or to the elements in exterior locations. | [A6][A7][A14] [<i>Insert alternative</i>]] |
| Galvanized structural and miscellaneous steel exposed to view inside buildings. | A2 |

3.11 CONCRETE AND MASONRY SURFACES COATING SCHEDULE

Surfaces to be coated shall include new work and surfaces disturbed by the Work. Surfaces that are not disturbed will not require recoating unless noted otherwise on the Drawings.

| Surface To Be Coated | Finish Coating System |
|--|--|
| [All concrete and concrete block [in corrosive areas] (Except floors and surfaces scheduled to receive other coatings) which are exposed to view. | [Indoor –C2][<i>Insert alternative</i>] [Outdoor –C7][<i>Insert alternative</i>]] |
| [Interior surfaces of filter wash water flumes. | [C5][<i>Insert alternative</i>]] |
| [Filter wash water troughs. | [C5][<i>Insert alternative</i>]] |
| [Interior surfaces of sludge drawoff boxes. | [C10][<i>Insert alternative</i>]] |
| [Concrete block surfaces in carbon handling rooms and janitors closets. | [C2][<i>Insert alternative</i>]] |
| [Where indicated on the Drawings, walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment. | [C2][<i>Insert alternative</i>]] |
| [All walls in contact with liquid where the opposite face forms a part of an interior room or dry pit. | [C4][C5][<i>Insert alternative</i>]] |
| [All walls in contact with treated or potable water where the opposite face is above grade or which form is a part of an interior room or a dry pit. | [C5][<i>Insert alternative</i>]] |
| [All surfaces, including basin walls, in contact with treated or potable water. | [C5][<i>Insert alternative</i>]] |
| [All interior surfaces of walls in flocculation basins where the wall is also part of an interior room or dry pit. | [C5][<i>Insert alternative</i>]] |
| [All interior surfaces of walls in a clearwell where the wall is also part of an interior room or dry pit. | [C5][<i>Insert alternative</i>]] |
| [Interior walls of filter boxes, full height above underdrains and including edges of walkways. | [C5][<i>Insert alternative</i>]] |
| [Interior walls for architectural finish only | [C2,][C15] [<i>Insert alternative</i>]] |

F1 Protective Coatings

| SURFACE DESCRIPTION | SYSTEM NO. |
|---------------------|------------|
| | |

| SURFACE PREPARATION DESCRIPTION |
|---|
| <input type="checkbox"/> Solvent SSPC-SP1 <input type="checkbox"/> Ferrous Metal Nonimmersion SSPC-SP6 <input type="checkbox"/> Ferrous Metal Immersion <input type="checkbox"/> SSPC-SP10 <input type="checkbox"/> SSPC-SP-5 <input type="checkbox"/> Other |

| COATING | DFT mils | MANUFACTURER AND PRODUCT |
|----------------------------|----------|--|
| First Coat (Primer) | | |
| Second Coat | | |
| Third Coat | | |
| Total System | | Not less than minimum thickness specified. |

| |
|------------------------------|
| Notes: (Attached if needed.) |
| |

| | |
|------------------------|----------------|
| Project: | |
| Coatings Manufacturer: | Initials _____ |
| Painting Applicator: | Initials _____ |

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| |
|--|
| SHOP PRIMED SURFACE DESCRIPTION SYSTEM NO. - -F |
| |

| |
|---|
| SURFACE PREPARATION DESCRIPTION |
| <input type="checkbox"/> Solvent SSPC-SP1 <input type="checkbox"/> Other |

| COATING | DFT mils [µm] | MANUFACTURER AND PRODUCT |
|---------------------|---------------|--|
| Shop Primer | | (Identify Product/Type) |
| Touchup | | |
| Intermediate Coat | | |
| Finish Coat | | |
| Total System | | Not less than minimum thickness specified. |

| |
|------------------------------|
| Notes: (Attached if needed.) |
| |

| | |
|------------------------|----------------|
| Project: | |
| Coatings Manufacturer: | Initials _____ |
| Painting Applicator: | Initials _____ |

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Miscellaneous Specialties
SECTION 10 99 00 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1-1. SCOPE. This section covers the miscellaneous items of work not covered in other sections, including:

Fire Extinguishers
Splash Blocks

1-2. GENERAL. Miscellaneous specialties shall be furnished and installed as specified herein and in accordance with the details, arrangements, and dimensions indicated on the Drawings. Where not specifically indicated or specified, fasteners, gaskets, and other accessories shall be provided as required and as recommended by the manufacturer of the specific item.

1-3. SUBMITTALS. Complete specifications, detailed drawings, and setting or erection drawings covering miscellaneous specialties shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. PORTABLE FIRE EXTINGUISHERS.

2-1.01. Multipurpose Dry Chemical Fire Extinguisher. Not used.

2-1.02. Carbon Dioxide Fire Extinguisher.

The fire extinguishers which are noted below to be UL-approved for Class C fires and shall have a 10-pound capacity, such as Badger "B10V-1", Buckeye "10CD", or approved equal. Finish of shell shall be red with all metal handle and valve.

2-1.03. Fire Extinguisher Schedule. Wall-mounted fire extinguishers shall be mounted on suitable wall brackets at the specific locations designated by the Engineer. The following fire extinguishers shall be provided:

Effluent Pump Station

| Room Location | Quantity | Mounting |
|-----------------|----------|--------------|
| Electrical Room | 2 | Wall Bracket |

2-2. Splash Blocks. Precast reinforced concrete splash blocks shall be provided at the locations indicated on the Drawings. The blocks shall be approximately 16 inches wide by 30 inches long by 5 inches high, with curbs on three sides. The splash portion shall be sloped from not less than 1 inch depth at the inlet end to not less than 2 inches at the outlet end. The block shall be reinforced with not less than WWF4X4-W4XW4 welded wire fabric.

Miscellaneous Specialties
PART 3 - EXECUTION

3-1. INSTALLATION. All products herein shall be installed as recommended by the manufacturer and as indicated on the Drawings. All moving parts shall be properly lubricated and adjusted as required for proper operation.

End of Section

SECTION 22 05 11 - BASIC MECHANICAL BUILDING SYSTEMS MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers general mechanical building system requirements as referenced from other sections and furnishing and installation of:

1. Mechanical identification
2. Special coatings

for the heating and ventilating systems. Protective coatings for ductwork and equipment without special coatings shall be as specified in the Protective Coatings sections.

1.2 GENERAL

- A. Materials furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the manufacturer unless exceptions are noted by the Engineer.

B. Coordination

1. Where two or more units of the same class of materials are required, they shall be the product of a single manufacturer; however, all the component parts of the system need not be the products of one manufacturer.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standards

1. Except as modified or supplemented herein, all work covered by this section shall be performed in accordance with all applicable local codes and ordinances, laws, and regulations which pertain to such work. In case of a conflict between these specifications and any state law or local ordinance, the latter shall govern.

E. Metal Thickness

1. Metal thickness and gages specified herein are minimum requirements. Gages refer to US Standard gage.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete information, detailed specifications, and data covering materials, parts, devices, and accessories forming a part of the materials furnished, shall be submitted in accordance with the Submittals Procedures section.

Number Plates

Product data on number plates.

A listing of equipment to receive number plates shall be submitted.

Special Coatings

Name of manufacturer.

Coating type.

Color.

Chemical resistance data.

Temperature range data.

Surface preparation.

Application data.

Film thickness per coat.

Drying and curing time information.

Equipment Motors

Name of Manufacturer.

Type and Model.

Horsepower (kW) rating and service factor.

Temperature rise and insulation rating.

Full load rotative speed.

Type of bearings and method of lubrication.

Net weight.

Overall dimensions.

Efficiency at full, 3/4, and 1/2 loads.

Full load current and power factor.

Locked rotor current.

Adjustable Frequency Drives

Type and model.

Name of manufacturer.

Operating speed range, rpm.

Rated bhp [kW] at maximum speed.
Efficiency at maximum speed, percent.
Maximum heat output, BTUH [kW].
Speed at maximum heat output, rpm.
Dimensions and net weight of complete panel.
Catalog and data sheets on all components.
Electrical schematics and wiring diagrams.

1.4 QUALITY ASSURANCE

A. Welding Qualifications

1. All welding procedures and welding operators shall be qualified by an independent testing laboratory in accordance with the applicable provisions of AWS Standard Qualification Procedures. All procedure and operator qualifications shall be in written form and subject to Engineer's review. Accurate records of operator and procedure qualifications shall be maintained by Contractor and made available to Engineer upon request.

B. Manufacturer's Experience

1. Unless the equipment manufacturer is specifically named in this section, the manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. All equipment shall be designed and selected to meet the specified conditions. Where equipment is provided with special coatings, unit capacities shall be corrected to account for any efficiency losses from the selected special coating.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

1. Dimensional Restrictions

- a. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values of the first manufacturer listed. Contractor shall review the contract Drawings, the manufacturer's layout drawings, and installation requirements and shall make any modifications required for proper installation subject to acceptance by Engineer.

2. Elevation

- a. Equipment shall be designed to operate at the elevation indicated in the Contract Drawings.
3. Equipment Efficiencies
- a. Unless otherwise indicated in the respective equipment paragraph, the equipment efficiency shall be in accordance with the requirements of ASHRAE Energy Standard 90.1.

4. Drive Units

- a. Drive units shall be designed for 24 hour continuous service.
 - 1) Electric Motors
 - a) Motor horsepower scheduled on the Drawings are minimum motor horsepower. Larger motors shall be provided if required to meet the specified capacities for the equipment furnished. Motors furnished with equipment shall meet the following requirements.
 - 1. Premium efficient motors with a minimum efficiency of at least that specified in the Common Motor Requirements for Process Equipment section shall be provided where available as a standard option. All other motors shall meet the minimum efficiency standards required by the 2007 Energy Independence and Security Act.
 - 2. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
 - 3. Rated for continuous duty at 40° C ambient.
 - 4. Motors used in applications which exceed the usual service conditions as defined by NEMA, such as higher than 40° C ambient, altitude exceeding 3,300 feet, explosive or corrosive environments, departure from rated voltage and frequency, poor ventilation, frequent starting, or adjustable frequency drive applications, shall be properly selected with respect to their service conditions and shall not exceed specified temperature rise limits in accordance with ANSI/NEMA MG 1 for insulation class, service factor, and motor enclosure type.
 - 5. To ensure long life, motors shall have nameplate horsepower [kW] equal or greater than the maximum load imposed by the driven equipment and shall carry a service factor rating as follows:

| <u>Motor Size</u> | <u>Enclosure</u> | <u>Service Factor</u> |
|-------------------|------------------|-----------------------|
| Fractional hp | Open | 1.15 |
| | Other Than Open | 1.0 |
| Integral hp | Open | 1.15 |
| | Other Than Open | 1.0 |

Motors used with adjustable frequency drives shall have a 1.15 service factor on sine wave power and a 1.0 service

- factor on drive power.
6. Designed for full voltage starting.
 7. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion according to IEEE 519.
 8. Totally enclosed motors shall have a continuous moisture drain that also excludes insects.
 9. Bearings shall be either oil or grease lubricated.
 10. Motor nameplates shall indicate as a minimum the manufacturer name and model number, motor horsepower, voltage, phase, frequency, speed, full load current, locked rotor current, frame size, service factor, power factor, and efficiency.
 11. Dripproof motors, or totally enclosed motors at Contractor's option, shall be furnished on equipment in indoor, above-grade, clean, and dry locations.
 12. Totally enclosed motors shall be furnished on:
 - (A) All equipment..
 13. Explosionproof motors shall be furnished as specified by applicable codes or as specified in other sections.
 14. A manufacturer's standard motor may be supplied on packaged equipment and fans in which case a redesign of the unit would be required to furnish motors of other than the manufacturer's standard design. However, in all cases, the motor types indicated are preferred and shall be furnished if offered by the manufacturer as a standard option.
 15. Motors used with adjustable frequency drives shall have insulation system meeting the requirements of NEMA MG 1, Part 31.

B. ADJUSTABLE FREQUENCY DRIVES

1. Adjustable frequency drives shall be provided as indicated on the Drawings and shall be coordinated with the requirements of the associated equipment. The equipment manufacturer shall be responsible for furnishing the adjustable frequency drive, for matching the motor and the drive, and for coordinating the collection of data and the design to limit harmonics to the levels specified.
2. All equipment shall be derated as recommended by the drive and motor manufacturers for reduced speed operation with an adjustable frequency controller in addition to any derating requirements specified elsewhere.
3. Each drive shall be pulse-width modulated type and shall produce an adjustable AC voltage/frequency output. Each drive shall maintain a minimum displacement power factor of 0.95 over the entire speed range, and shall be equipped with an output voltage regulator to maintain correct output V/Hz despite incoming voltage variations.

4. Each drive shall be equipped with an input line reactor and a full-wave diode bridge rectifier to convert incoming fixed voltage/frequency to a fixed DC voltage. The pulse-width modulation technology shall be of the space vector type, implemented in a microprocessor, which generates a sine-coded output voltage.
5. The drive inverter output shall be generated by insulated gate bipolar transistors (IGBT) which shall be controlled by six identical base driver circuits. The drive shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque, and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation. Each drive shall be configurable for automatic and manual reset and shall have an adjustable carrier frequency to at least 6000 Hz.
6. Each drive shall contain a circuit breaker and a control transformer for 120V control.
7. Each drive shall be installed in a NEMA 4X enclosure. The drive shall have complete front accessibility with easily removable assemblies. Cable entry shall be top or bottom entry.
8. All drives shall be pulse-width modulated type as manufactured by ABB, Eaton, Rockwell Automation, Seimens W-Series, Schneider-Electric, or Toshiba without exception. All adjustable frequency drives shall be a product of the same manufacturer.

2.3 MANUFACTURE AND FABRICATION

A. Welding

1. All welds shall be continuous (seal type) on submerged or partially submerged components.

B. Anchor Bolts and Expansion Anchors

1. Anchor bolts, expansion anchors, nuts, and washers shall be as indicated in the Post Installed Anchors section unless otherwise indicated on the Drawings.

C. Edge Grinding

1. Sharp corners of cut or sheared edges which will be submerged in operation shall be dulled by at least one pass of a power grinder to improve paint adherence.

D. Surface Preparation

1. All iron and steel surfaces, except motors, shall be shop cleaned by sandblasting or equivalent, in strict conformance with the paint manufacturer's recommendations. All mill scale, rust, and contaminants shall be removed before shop primer is applied.

2.4 MATERIALS

A. Mechanical Identification

Basic Mechanical Building Systems Materials and Methods

1. Mechanical identification consisting of equipment number plates, equipment information plates, valve tags, and ductwork identification shall conform to the requirements of the Equipment and Valve Identification section and as indicated herein.
2. Number Plates
 - a. Hand-lettered or tape labels will not be acceptable.
 - b. Number plates for control equipment such as but not limited to thermostats, control stations, and emergency ventilation shutoff switches shall in addition to the specific device identification list the controlled equipment in parenthesis below the device number.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Materials furnished under this section shall be installed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by the Engineer.
- B. The installation of identifying devices shall be coordinated with the application of covering materials and painting where devices are applied to surfaces. All surfaces to receive adhesive number plates shall be cleaned before installation of the identification device.

End of Section

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SECTION 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the furnishing and installation of heating, ventilating, and air conditioning (HVAC) equipment, devices, and appurtenances associated with the HVAC systems.
- B. Piping, pipe supports, valves, and accessories which are not an integral part of the equipment or are not specified herein are covered in other sections.

1.2 GENERAL

- A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.
- B. Coordination
 - 1. Contractor shall verify that each component of the system is compatible with all other parts of the system; that all piping, ductwork, materials, fans, and motor sizes are appropriate; and that all devices necessary for a properly functioning system have been provided.
 - 2. Where two or more units of the same class of equipment are needed, they shall be the product of a single manufacturer; however, all the component parts of the system need not be the products of one manufacturer.
- C. General Equipment Stipulations
 - 1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.
- D. Seismic Design Requirements
 - 1. Seismic design requirements for products specified herein shall be as indicated in the Contract Drawings.
- E. Governing Standards
 - 1. Except as modified or supplemented herein, all work covered by this section shall be performed in accordance with all applicable municipal codes and ordinances, laws, and regulations. In case of a conflict between this section and any state law or local ordinance, the latter shall govern.

Heating, Ventilating, and Air Conditioning

2. All work shall comply with UL safety requirements.

F. Power Supply

1. Power supply to equipment with motors shall be as indicated in schedules on the Drawings. Power supply for controls shall be 120 volts, 60 Hz, single phase unless otherwise required for a properly operating system.

G. Metal Thickness

1. Metal thickness and gages specified herein are minimum requirements. Gages refer to US Standard gage.

H. Mechanical Identification

1. Mechanical identification shall conform to the requirements of the Basic Mechanical Building Systems Materials and Methods section.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete assembly and installation drawings, and wiring and schematic diagrams, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals Procedures section. Device tag numbers indicated on the Drawings shall be referenced on the wiring and schematic diagrams where applicable. The data and specifications for each unit shall include, but shall not be limited to, the following:

a. Fans

- 1) Name of manufacturer.
- 2) Type and model.
- 3) Construction materials, thickness, and finishes.
- 4) Overall dimensions and required clearances.
- 5) Net weight and load distribution.
- 6) Performance curves with the specified operating point clearly identified for each unit, type, and model, with capacity in cubic feet per minute as the abscissa and brake horsepower, static pressure, and efficiency as the ordinate. The fan curves shall include a family of curves for at least 3 different rotative speeds on a single chart.
- 7) Certified AMCA standard test code sound power output data for the fan outlet and casing when operating at the specified volume flow rate. Sound data shall list dB re 10⁻¹² watts in each octave band, with midrange frequencies starting at 63 Hz and ending at 8,000 Hz.
- 8) Where specified, information on equipment manufacturers' representatives.

b. Equipment (not specifically listed)

- 1) Name of manufacturer.
- 2) Type and model.
- 3) Construction materials, thickness, and finishes.

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- 4) Manufacturer's performance data.
 - 5) Overall dimensions and required clearances.
 - 6) Net weight and load distribution.
 - 7) Wiring diagrams.
- c. Sheet Metal Ductwork
- 1) Sheet metal duct fabrication drawings indicating dimensions of individual shop and field fabricated sections, top and/or bottom duct elevations, joint locations, and dimensions of duct from walls or column rows.
 - 2) Pressure and seal classifications.
 - 3) Reinforcement types and spacing.
 - 4) Joint and seam types.
 - 5) Hanger and support types, spacing, and attachment methods.
 - 6) Access panel and door construction, sizes, and locations.
 - 7) Duct sealant, adhesive, gasket, and tape information.
- d. Temperature Controls
- 1) Published descriptive data on each item of equipment and accessories, indicating all specific characteristics and options and identified with the designation used herein and on the Drawings.
 - 2) Schematic control diagrams giving specific data on all settings, ranges, actions, adjustments, and normal positions. Although schematic, these diagrams shall, as closely as possible, represent the actual system with all significant equipment and devices identified and located relative to each other. These diagrams shall also show detailed multiline wiring with all terminals accurately identified. The wiring diagrams shall show the internal connections of the temperature control panels and all field wiring to equipment remote from the control panels, including wiring to Owner-furnished equipment. The wiring diagrams shall be complete, showing all connections necessary to place the temperature control systems in operation. Wiring diagrams shall be detailed to the degree necessary for field construction and shall include all related wiring.
 - 3) Sequence of operation for each system corresponding to the control schematics.
 - 4) Detailed panel construction drawings, including description of all materials and finishes, complete internal wiring and piping schematics, panel face layout, and complete data on all mounted components.
 - 5) Space thermostat schedule indicating the types of covers and means of adjustment for each space.
 - 6) Conduit and wire types.
 - 7) Where specified, information on equipment manufacturers' representatives.

B. Operation and Maintenance Data and Manuals

1. Adequate operation and maintenance information shall be supplied as required in the Submittals Procedures section. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

Heating, Ventilating, and Air Conditioning

2. In addition to the requirements of the Submittals Procedures section, the operation and maintenance manuals shall include a listing of all filter locations, types, sizes, and quantities associated with each piece of equipment.

1.4 QUALITY ASSURANCE

- A. Quality assurance shall comply with the requirements of the Basic Mechanical Building Systems Materials and Methods section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and Storage shall be in accordance with the Product Storage and Handling Requirements section.

1.6 EXTRA MATERIALS

- A. Extra materials shall be furnished for the equipment as specified in the individual equipment paragraphs.
- B. Extra materials shall be packaged in accordance with the Product Delivery Requirements section, with labels indicating the contents of each package. Each label shall indicate manufacturer's name, equipment name, equipment designation, part nomenclature, part number, address of nearest distributor, and current list price. Extra materials shall be delivered to Owner as directed.
- C. Extra materials subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. All equipment shall be designed and selected to meet the specified conditions.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Equipment and coil capacities shall be as indicated on the schedules. Where equipment is provided with special coatings, unit capacities shall be corrected to account for any efficiency losses from the selected special coating.
- B. Each fan's operating selection point on the fan curves shall be selected to the right of the peak pressure/efficiency point and below the lowest point along the fan curve to the left of the peak pressure/efficiency point.

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C. Dimensional Restrictions

1. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values of the first manufacturer listed. Contractor shall review the contract Drawings, the manufacturer's layout drawings, and installation requirements and shall make any modifications required for proper installation subject to acceptance by Engineer. At least 3 feet of clear access space shall be provided on all sides of the unit unless otherwise indicated.

D. Elevation

1. Equipment shall be designed to operate at the elevation indicated in the Contract Drawings.

2.3 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed in the respective product description paragraphs.

2.4 MATERIALS

A. Heaters

1. Heaters of the types, sizes, and capacities specified herein shall be furnished and installed where indicated on the Drawings. All heaters shall be complete with controls and accessories required for satisfactory operation. Heaters shall be UL listed unless otherwise indicated.
2. Electric Unit Heaters
 - a. Electric unit heaters, denoted by the symbol "EUH" and an identifying number, shall have the capacity indicated in the schedules on the Drawings.
 - 1) Electric Unit Heaters (corrosion resistant)
 - a) Where indicated on the Drawings to be corrosion resistant, unit heaters shall be manufactured by Chromalox "HD3D," Ruffneck "CR1 Triton," or Indeeco "Triad." Each heater shall include fan and motor assembly, operating and safety controls, disconnect switch, and shall be suitable for use with a single point power supply indicated in the schedules on the Drawings.
 - b) Heater elements shall be Type 304 or 316 stainless steel, fin tubular type, with stainless steel fittings forming a watertight seal between the elements and the junction box. Unit heater fan motors shall be totally enclosed, permanently lubricated ball bearing type designed to resist corrosion and moisture. The fan blades shall be epoxy coated aluminum and the heater housing shall be at least a 20 gage Type 304 stainless steel. Where indicated on the Drawings to be wall hung, a swivel wall mounting bracket shall be provided.
 - c) The controls shall include automatic reset thermal cutout, fan delay relay, built-in control and motor contactors, control transformer, and

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terminal block all housed in a NEMA 4X enclosure. A pilot light visible on the heater exterior shall indicate heater operation.

B. Fans

1. Fans shall be rated in accordance with AMCA standards, shall be licensed to bear the AMCA Certified Rating Label unless otherwise indicated in the Fan Schedule on the Drawings, and shall be UL listed. Surfaces in contact with the airstream shall comply with the requirements of ASHRAE 62.1.
2. Each fan shall be complete with an electric motor, factory mounted safety disconnect switch with wiring to the motor, drive, and accessories required for satisfactory operation. Belt-driven fans shall be complete with a V-belt drive designed for 50 percent overload capacity, sheaves, adjustable base or rails for belt tightening, and a belt guard. Adjustable pitch sheaves shall be furnished for fans. Adjustable sheaves shall be selected so that the fan speed at the specified conditions is at the mid-position of the sheave range. Sheaves shall be replaced with sheaves of the proper size after the air system balancing if necessary, to provide the required fan speed for the specified airflow.
3. Fan drive motors shall be as specified in the Electrical paragraph, unless otherwise indicated. Fans shall be suitable for use with the power supply indicated on the Drawings.
4. The external static pressure values indicated in the schedules on the Drawings are external to the complete unit. Internal fan housing and when furnished, backdraft damper and filter losses are not included.
5. Fans shall come with adjustable frequency drives where indicated in the Schedules on the Drawings.
6. Where indicated in the schedules on the Drawings, fans shall be given a special coating resistant to the corrosive atmosphere indicated.
7. Propeller Fans
 - a. Propeller fans, denoted by the symbol "EF" and an identifying number, shall be Greenheck "Model AER" for direct drive and "Model SB/SBC" for belt drive, PennBarry, or Loren Cook.
 - b. Propeller fans shall consist of a panel frame, wire guard, motor, fan blades, and a disconnect switch. Fan blades shall be constructed of aluminum. Propeller fans shall be statically and dynamically balanced to ensure quiet, vibration-free operation, and be suitable for mounting as indicated.
 - c. Fan manufacturer to furnish adjustable frequency drive. Electrically commuted motor and controls are acceptable. Refer to adjustable frequency drive section in specification 22 05 11.

C. Dampers

1. Control Dampers

- a. Control dampers shall be denoted by the symbol "CD" and an identifying number. Dampers with an area larger than 25 square feet or with any blade dimension

exceeding 48 inches shall be built in sections. All dampers shall be carefully inspected before and after installation, and any damper having poorly fitted blades, insufficient framed rigidity, or excessive clearance or backlash in moving parts will be rejected and shall be replaced with an acceptable unit. The leakage rate shall not exceed 4 cubic feet per minute per ft² when tested at 1 in wc for all sizes 24 inches wide and above.

- b. Two-position dampers shall have parallel operating blades. Modulating dampers shall have opposed operating blades.
- c. Damper blades shall be installed on a steel shaft operating in synthetic bearings suitable for industrial service. Dampers shall be close-fitting and shall be designed to offer minimum resistance to the airflow when in the fully open position. Damper blade linkage shall be concealed in the frame.
- d. Control dampers shall be given a special coating identical to the coating applied to the connected ductwork and equipment.
 - 1) Wall Mounted Control Dampers. Control dampers mounted in walls behind louvers shall be Arrow United Industries "Type AFD-20" or Ruskin "CD-40." Control damper frames shall be constructed of 4 by 1 inch 6063 T5 extruded aluminum. Damper blades shall be constructed of 4 inch wide airfoil-shaped extruded aluminum.

D. Damper Operators

1. The damper operators shall be direct coupled or foot-mounted type. Each operator shall be complete with all necessary crank arms, ball joint connectors, push rods, linkages, and mounting brackets.
2. Each operator shall have sufficient torque to operate the connected control damper based on at least 130 percent of control damper area. Each damper operator shall have at least a 50 inch-pound normal running torque. Where the required damper torque exceeds the damper operator running torque rating, multiple operators or operators with a greater running torque shall be furnished to produce the torque required to operate the damper. Control dampers shall fail to the closed position unless otherwise indicated on the Drawings.
3. Two-position direct coupled electric damper operators shall be Belimo "NFBUP-S" or "AFBUP-S," Honeywell "MS4100 Series," or Johnson Controls.
4. Damper operators shall be spring return and shall have one internal spdt auxiliary switch rated 5 amperes at 120 volts ac or the power supply available from the temperature control system furnished. Damper operators shall be suitable for operation on a 120 volt, 60 Hz, single phase power supply. Auxiliary transformers, where required, shall be factory wired to the damper operator and installed in a NEMA enclosure with a rating equal to or better than the damper operator. Operators shall be housed in a NEMA 4X enclosure.
 - a. Direct coupled two position electric damper operators shall be housed in a galvanized steel or aluminum case. Operators shall use a "V" shaped bolt and cradle design to eliminate slippage on the damper shaft. Single bolt or set screw type designs are not acceptable for round shafts. The operators shall be suitable for

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direct mounting to shafts up to 1 inch and shall be complete with mounting brackets and damper position indicator.

E. Access Doors

1. Access doors shall be fabricated in accordance with the latest SMACNA HVAC Duct Construction Standards. Access doors shall be double skin insulated type for insulated ductwork and single skin type for noninsulated ductwork. Insulated doors shall be insulated with the same thickness insulation as the duct in which it is installed. Duct-mounted access doors and panels shall be fabricated of the same material as the ductwork, with sealing gaskets and quick-fastening locking devices. Where access doors are insulated, a sheet metal cover shall be installed over the insulation.

F. Temperature Controls

1. The temperature control components and systems shall be manufactured by Honeywell; Johnson Controls; or Siemens Building Technologies, Landis Division. Where manufacturers are not specified, materials and equipment furnished shall meet the performance and design requirements indicated.
2. Performance and Design Requirements
 - a. Contractor shall coordinate with the Work to make certain that the field wiring associated with the work of this section is completed in accordance with the requirements of the heating, ventilating, and air conditioning equipment furnished and their interconnection. Where cable and conduit is not indicated on the Drawings but is needed for a complete and functional control system in accordance with the sequence of operation it shall be provided as specified herein. The control wiring shall be installed so that all HVAC equipment will function as described in the HVAC sequence of operation.
 - b. Conduit and control wiring for all control circuits needed between all field mounted HVAC controlling and indicating devices, such as, but not limited to, damper actuators, thermostats, temperature control panels, pressure differential switches, control switches, motor starters, and the HVAC equipment, shall be furnished and installed as specified in the Electrical Wiring paragraph. Cable and conduit for all HVAC power circuits shall be as specified in the Electrical section.
3. Tolerances
 - a. Unless otherwise indicated, the controls shall maintain space temperatures within $\pm 2^{\circ}$ F , and the relative humidity within ± 5 percent of the setpoint.
4. Thermostats
 - a. Where indicated on the Drawings, thermostats shall be constructed of materials resistant to or shall be protected from the corrosive atmosphere indicated. Thermostats specified in the individual equipment paragraphs shall be provided with the respective equipment.
 - 1) Two Position Corrosion Resistant Wall Mounted Thermostats
 - a) Two position wall mounted thermostats used in wet or corrosive environments shall be Honeywell "T631F..

- b) Two position corrosion resistant wall mounted thermostats shall be line voltage type. The thermostats shall have a range of approximately 35° F to 100° F with a nonadjustable differential of 3.5° F. The thermostats shall have a spdt switch rated for 1 horsepower.
- c) Thermostats shall be in NEMA 4X enclosures.
- 2) Low Limit Thermostats
 - a) Low limit thermostats shall be Honeywell “L480,” Penn Controls “Model A11B-1,” or Siemens Building Technologies.
 - b) Low limit thermostats used for low temperature cutout shall be capillary, line-voltage type, complete with spst switches. The sensing elements shall be at least 20 feet long. The thermostat shall be responsive to the lowest temperature along the measuring element, shall have a range of approximately 35° F to 45° F , and shall be automatically reset.
 - c) Thermostats shall be in NEMA 4X enclosures.

5. Temperature Control Panels

- a. Temperature control panels, denoted by the symbol “TCP” and an identifying number, shall be manufactured by Hoffman Engineering, Hubbell Wiegman, or Rittal Corporation. Temperature control panel enclosures shall be NEMA Type 4X unless otherwise indicated on the electrical Drawings with a special area designation. Where a panel is located in a room with a special area designation, the panel shall be constructed to meet the special area designation requirements. Panels shall be designed for wall mounting and shall be completely prewired and checked. All electrical accessory devices and internal wiring shall be furnished and installed.
- b. Where required by the applicable codes and ordinances, panel assemblies, materials, and equipment shall be approved, identified, labeled, or listed by Underwriters’ Laboratories or other testing agency acceptable to the governing authority.
- c. All controllers, selector relays, switching relays, interlock relays, manual switches, timers, alarm, and other devices indicated to be panel mounted shall be mounted in or on the respective control panel. Accessories such as indicating lights, pushbuttons, alarm horns, and selector switches shall be mounted on the front hinged covers of the panels. The accessories and panels shall be identified with an identification plate as described in the Equipment Identification paragraph. The identification plates shall be fastened to the panel with corrosion-resistant pan head screws.
- d. Each temperature control panel shall supply power to all associated control system field control components, including but not limited to, damper operators, thermostats, sensors, and smoke detectors. The controls shall include all necessary relays, interlocks, and control devices to enable the control panel to function as described in the sequence of operation on the Drawings.
- e. All interconnecting wiring and wiring to terminals for exterior connection shall be stranded copper, insulated for not less than 600 volts, with a moisture resistant and flame resistant covering rated for at least 90°C. Power distribution wiring on the line side of panel fuses shall be at least 12 AWG. Wiring for secondary power distribution and for control, annunciator, and indicating light circuits shall be at

least 14 AWG. Wiring shall be color coded in accordance with the legend on the panel wiring diagrams.

- f. Equipment operational control and run/off status shall be provided from terminal blocks within the respective motor starter. Refer to the electrical Drawings for additional information.

1) Selector Switches

- a) Selector switches shall be Micro Switch "Type PT," Cutler-Hammer "10250T Series ," or General Electric "CR." Selector switches shall be heavy-duty 30 mm oiltight type with gloved-hand or wing lever operators. Position legends shall be engraved on switch faceplate. Switches for electric circuits shall have silver butting or sliding contacts, rated 10 amperes continuous at 120 volts ac. Contact configuration shall be as indicated on the Drawings or as necessary for the application. Switches used in electronic signal circuits shall have contacts suitable for that duty.

2) Push Buttons

- a) Push buttons shall be Micro Switch "Type PT," Cutler-Hammer "10250T Series," or General Electric "CR." Push buttons shall be heavy-duty, oiltight type, with legends engraved on the faceplate. Contacts shall be rated 10 amperes continuous at 120 volts ac.

3) Indicating Lights

- a) Indicating lights shall be Micro Switch "Type PT," Cutler-Hammer "10250T Series ," or General Electric "CR." Alarm, indicator, and running status lights shall be furnished with lamps. Indicating lights shall be heavy-duty, 30 mm, push-to-test, oiltight type with LED lamps. Legends shall be engraved on the lens or on a legend faceplate. Lamps shall be easily replaceable from the front of the device.

4) Alarm Horns

- a) Alarm horns shall be Federal Signal "Model 350." Alarm horns shall have a sound output of 100 dB at 10 feet [3 m]. Horns shall be furnished with mounting hardware suitable for flush mounting.

5) Relays

- a) Relays shall be Eagle Signal "Series 22, 80"; Potter & Brumfield "Series KRP, CB"; or Struthers-Dunn "Series A3, A4." Relays shall be of the plug-in socket base type, with dustproof plastic enclosures unless noted otherwise. Relays shall be UL recognized and shall have not less than double-pole, double-throw contacts. Control circuit relays shall have silver-cadmium oxide contacts rated 10 amperes at 120 volts ac. Electronic switching-duty relays shall have gold-plated or gold alloy contacts suitable for use with low level signals. Relays used for alarm input or indicating light service shall have contacts rated at least 3 amperes. Time-delay relays shall have dials or engraved switch settings marked in seconds and shall have timing repeatability of ± 2 percent of setting. Latching and special purpose relays shall be as needed for the specific application.

6) Terminal Blocks and Panel Wiring

- a) Terminal blocks for external connections shall be suitable for 12 AWG wire and shall be rated 30 amperes at not less than 300 volts. Terminal blocks shall be fabricated, shall be complete

with marking strip, covers, and pressure connectors, and shall be labeled to agree with the identification on the temperature control manufacturer's submittal drawings.

- b) A terminal shall be provided for each conductor of external circuits, plus one ground cable. At least 8 inches of clearance shall be provided between the terminal strips and the base of vertical panels for conduit and wiring space. At least 25 percent spare terminals shall be provided.
 - c) All wiring shall be grouped or cabled and firmly supported inside the panel. Wiring shall be bundled in groups and bound with nylon cable ties or shall be routed in Panduit or similar nonmetallic slotted ducts. Ducts shall be readily accessible within the panel, with removable covers, and shall have a space of at least 40 percent of the depth of the duct available for future use after the installation including all field wiring, has been completed. Sufficient space shall be provided between cable groups or ducts and terminal blocks for easy installation or removal of cables.
 - d) Where signal wiring must be routed to more than one panel or device, the requested circuit routing shall be as indicated on the electrical one-line diagrams.
- 7) Control Power Transformers
- a) Where 24 volt ac control power is necessary for the temperature control components, 120/24 volt transformers shall be furnished and mounted in the respective temperature control panel. Control power transformers shall be sized by the manufacturer based on the equipment load of the panel, shall be copper wound, vacuum impregnated with solid polyester varnish, and shall be 100 percent tested in strict compliance with ANSI, CSA, and UL codes. Control power transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded. The control power transformers shall be sized by the manufacturer based on the equipment load of the panel.
- 8) Painting
- a) Interior and exterior surfaces of all panels shall be thoroughly cleaned and painted with rust-inhibitive primer. The panel interior shall be painted white with the manufacturer's standard coating. All pits and blemishes in the exterior surfaces shall be filled before the surface is painted with one or more finish coats of the manufacturer's standard coating. Finish coats shall have a dry film thickness of at least 4 mils . One quart of paint shall be furnished with the panels for future touchup painting.

6. Humidistats

- a. Humidistats denoted by the symbol "H" and an identifying number, shall be Honeywell "H46C", Johnson Controls, or Siemens Building Technologies.
- b. Humidistats shall have nylon element coupled to spst mercury contact that closes on a rise in relative humidity. Each humidistat shall have an adjustable range of 20 to 80 percent relative humidity and an operating differential of approximately 5 percent relative humidity.

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- c. Humidistats shall be in NEMA 4X enclosures.

7. Accessory Components

- a. All additional control components, including, but not limited to, electric relays, temperature sensors and transmitters, humidity sensors and transmitters, controllers, and position switches, shall be furnished where necessary to ensure a complete, properly operating installation. All components shall be products of the temperature control manufacturer. Accessory components not mounted inside the temperature control panels shall be furnished with equipment enclosures. Relays shall be provided with 120 volt coils and at least 10 ampere contacts.

8. Electrical Wiring

- a. Detailed wiring diagrams shall be submitted in accordance with the Submittals Procedures section. The wiring diagrams shall show the internal connections of the control panels and all field wiring to equipment remote from the control panels including wiring to Owner-furnished equipment. The wiring diagrams shall be complete, showing all connections necessary to place the temperature control systems in operation.
- b. Control wiring shall be in accordance with the National Electric Code (NEC). Cable shall be multi-conductor, at least 18 AWG size, specifically designed for industrial systems and UL listed for indoor/outdoor installations.
- c. Conduit for all HVAC control circuits in indoor locations shall be furnished and installed under this section. Conduit type shall be as specified in the Electrical Section.

2.5 ELECTRICAL

- A. Electric motors and motor controls shall conform to the Basic Mechanical Building Systems Materials and Methods section. Motor starters and controls shall be furnished and installed under the Electrical section, except for equipment specified or furnished with prewired integral starters. Disconnects for equipment shall be furnished and installed under the Electrical section, except where specified with integral disconnects. All electrical controls shall have enclosures suitable for the environment which shall be NEMA type 4X.
- B. Exhaust fan manufacturer shall furnish the adjustable frequency drives.
- C. Temperature controls contractor to furnish and install cable and conduit from the TCP to the adjustable frequency drive, exhaust fan and all other control devices.

2.6 DRIVE UNITS

- A. Electric motors, V-belt drives, and safety guards shall be in accordance with the requirements of the Basic Mechanical Building Systems Materials and Methods section.

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2.7 MANUFACTURE AND FABRICATION

- A. Manufacture and fabrication shall comply with the requirements of the Basic Mechanical Systems Materials and Methods section.

2.8 SHOP TESTING

- A. The equipment furnished under this section shall be tested at the factory according to the standard practice of the manufacturer. Ratings shall be based on tests made in accordance with applicable AMCA, ASHRAE, AHRI, NBS, NFPA, and UL Standards.

2.9 BALANCE

- A. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that the resonance at normal operating speeds is avoided. In any case, the maximum measured root-mean-square (rms) value as measured at any point on the equipment shall not exceed those listed in the latest ASHRAE Applications Handbook.
- B. At any operating speed, the ratio of rotative speed to the critical speed of a unit or components thereof shall be less than 0.8 or more than 1.3.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Equipment installed in facilities with limited access shall be suitable for being installed through available openings. Contractor shall field verify existing opening dimensions and other provisions for installation prior to submittal of bids.
- B. Where penetrations through existing concrete slabs are made, the Contractor shall locate and avoid damage to all rebar, embedded conduit, etc. when making new openings.

3.2 PREPARATION

- A. Field Measurement
 - 1. Contractor shall be responsible for verifying all field dimensions, and for verifying location of all equipment relative to any existing equipment or structures.
- B. Surface Preparation
 - 1. All surfaces to be field painted shall be dry and free of dirt, dust, sand, grit, mud, oil, grease, rust, loose mill scale, or other objectionable substances, and shall meet the recommendations of the paint manufacturer for surface preparation. Cleaning and

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painting operations shall be performed in a manner which will protect freshly painted surfaces from dust or other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss of previously painted surfaces shall be dulled if necessary for proper adhesion of top coats.

2. Surface finish damaged during installation shall be repaired to the satisfaction of Engineer. Field painting shall be as specified in the Architectural Painting and Protective Coatings sections.

3.3 INSTALLATION

- A. Equipment and materials furnished under this section shall be installed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. The space beneath baseplates shall be grouted as specified in the Grouting section.
- C. Heaters
 1. The bottom elevation of unit heaters shall be 8 feet above finished floor unless otherwise indicated.
- D. Fans
 1. Where fan inlets and outlets are exposed, safety screens shall be installed over the opening.
- E. Damper Operators
 1. Damper operators shall be installed on a mounting bracket rigidly attached to the damper frame or duct. Where the bracket attaches to the duct, suitable stiffeners shall be installed on the duct to prevent noticeable deflection of the duct when the damper operates. Damper operators may be installed inside or outside the duct but consideration shall be given to the environment and duct dimensions in which the operators are installed. Where the damper installation inside the duct may or actually prevents the design airflow from being achieved, the damper operator shall be installed outside the duct. Damper operators shall be readily accessible and access doors shall be provided when the operator is installed inside the duct.
 2. The damper operator shall be installed to prevent entry of moisture from contacting internal parts. Conduit shall enter the operator from below or horizontally and incorporate a drip leg to prevent water from following the conduit into the operator interior.
 3. The number of operators furnished for each damper shall provide the torque necessary to operate the damper. Unless otherwise indicated, control dampers shall fail to the closed position.
- F. Sheet Metal Ductwork

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1. Ductwork, turning vanes, and other accessories shall be installed and supported in accordance with the latest SMACNA Duct Construction Standards unless otherwise indicated. The locations, arrangement, and sizes of ductwork shall be as indicated on the Drawings. The duct sizes indicated are clear dimensions inside the duct or duct lining. Sheet metal sizes are larger for ductwork with interior linings.
2. Ductwork shall be fabricated, reinforced, supported, and sealed for the operating pressures indicated in the schedules for the connected equipment. All ductwork shall have a pressure classification of at least 1 inch .
3. Sheet metal ductwork shall be sealed according to the classifications described in the SMACNA HVAC Duct Construction Standards in accordance with the following:

| Duct Location | Duct Type | | | |
|---------------------|-----------------------|--------------------|---------|--------|
| | Supply | | Exhaust | Return |
| | ≤ 2 inches wc | > 2 inches wc | | |
| Unconditioned Areas | B | A | B | B |

Sealing Levels

A - All transverse joints, longitudinal seams, and duct wall penetrations
 B - All transverse joints and longitudinal seams
 C - Transverse joints only

4. All joints, seams, connections, and penetrations in ductwork located outdoors shall be sealed watertight and weatherproof. Transverse joints shall be flanged and shall be provided with a continuous gasket and flange cap.
5. Ductwork shall be supported as required by SMACNA. Where ductwork is connected to equipment, it shall be independently supported with no weight bearing on the equipment and in such a manner that the equipment maybe removed for service without temporary support of the ductwork. Ductwork shall be supported within 24 inches of each elbow and within 48 inches of each branch intersection. Strap or wire hangers shall not be used where the hanger length exceeds 5 feet .
6. Ductwork shall be constructed and installed in accordance with the Drawings. When acceptable to Owner, modifications in the size and location of ductwork may be made where required to avoid interference with the building structure, piping systems, or electrical work. The installation shall be coordinated with other phases of work to establish space and clearance requirements. Unless otherwise indicated by a bottom of duct elevation, all ductwork shall be routed as high as possible, with a minimum height of 8 feet above the finished floor.

G. Access Doors

1. Airtight access doors shall be provided for inspection of all dampers, operators, filters, smoke detectors, duct-mounted coils, and at other locations indicated on the Drawings. The access doors shall be of a size suitable for the duct dimensions and at least 8 inches

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square for hand access, 18 inches for shoulder access, or as indicated on the Drawings. Each access door shall be installed to open against the pressure in the duct.

H. Temperature Controls

1. Automatic temperature controls shall be furnished and installed as indicated on the Drawings and as specified herein.
2. Contractor shall be responsible for determining that all equipment supplied is suitable for installation in the space indicated on the Drawings. Control equipment shall be installed with adequate space for operating and maintenance access.
3. Temperature Control Panels
 - a. The panels shall be mounted so that selector switches and indicating lights on the panel are located approximately 5 feet above the finished floor.
4. Thermostats
 - a. Wall-mounted thermostats shall be mounted above the finished floors as indicated in the Electrical section. Insulating spacers shall be provided for thermostats mounted on exterior building walls. The spacers shall be installed between the thermostat and its mounting surface, so that the thermostat will not be affected by surface temperatures.
 - b. Wall-mounted thermostats in non air-conditioned areas shall be furnished and installed with a cast aluminum or wire guard.

3.4 FIELD QUALITY CONTROL

A. Installation Check

1. An installation check by an authorized representative of the manufacturer is not required for equipment specified in this section.

B. Startup and Testing

1. After the equipment and systems have been installed, adjusted, and balanced, tests shall be conducted to demonstrate that each system is functioning as specified and to the satisfaction of Engineer. Tests shall be as indicated in the Commissioning section.
2. If inspection or tests indicate defects, the defective work or material shall be replaced, and inspection and tests repeated. All repairs to piping shall be made with new materials. Caulking of threaded joints or holes will not be acceptable.

3.5 CLEANING

- A. At the completion of the testing, all equipment, pipes, ductwork, valves, and fittings shall be cleaned of grease, debris, metal cuttings, and sludge. Any stoppage, discoloration, or other

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damage to parts of the building, its finish, or furnishings shall be repaired by Contractor at no additional cost to Owner.

End of Section

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Testing, Adjusting, and Balancing

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the cleaning, testing, adjusting, and balancing of the air system(s) associated with the heating and ventilating systems.

1.2 GENERAL

- A. Equipment and systems shall be cleaned, tested, adjusted, and balanced in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.
- B. Coordination
 - 1. Contractor shall verify that all components and devices necessary for a properly functioning system have been provided. Prior to cleaning, testing, adjusting, and balancing, Contractor shall verify that each system has been installed properly and is operating as specified. Equipment bearings shall be lubricated in accordance with the manufacturer's recommendations.
 - 2. Air systems shall be complete and operating, with dampers, filters, ductwork, air outlet and inlet devices, duct mounted equipment, and control components.
- C. Governing Standards
 - 1. Except as modified or supplemented herein, all work covered by this section shall be performed in accordance with all applicable municipal codes and ordinances, laws, and regulations. In case of a conflict between this section and any state law or local ordinance, the latter shall govern.
 - 2. All work shall comply with the latest edition of AABC, NEBB, or SMACNA standard manuals for testing, adjusting, and balancing of air systems.

1.3 SUBMITTALS

- A. Drawings and Data
 - 1. Complete apparatus report sheets for all air systems shall be accurately and completely filled out in accordance with the Standard's manual. The testing and balancing results shall be submitted on the TAB report forms of the applicable standard. Copies of the final test readings and report sheets shall be submitted in accordance with the Submittals Procedures section. A description of the standard procedures used during testing, adjusting, and balancing shall be included in the submittal. The submittal shall include a

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reduced set of drawings, with the air outlet devices, air inlet devices, and equipment identified to correspond with the report sheets. Test dates shall be recorded on the individual TAB report forms indicating when the actual testing was performed.

2. The apparatus report sheets shall include the following information:

- a. Title Page:
 - 1) Company name
 - 2) Company address
 - 3) Company telephone number
 - 4) Project name
 - 5) Project location
 - 6) Project Engineer
 - 7) Project Contractor
 - 8) Project altitude
 - 9) Date
- b. Instrument List:
 - 1) Instrument
 - 2) Manufacturer
 - 3) Model
 - 4) Serial number
 - 5) Range
 - 6) Calibration date
- c. Air Moving Equipment:
 - 1) Unit number
 - 2) Location
 - 3) Manufacturer
 - 4) Model and serial number
 - 5) Airflow, design and actual
 - 6) Total static pressure (total external), design and actual
 - 7) Static pressure, inlet and discharge
 - 8) Total pressure
 - 9) Fan RPM, design and actual
- d. Electric Motors:
 - 1) Manufacturer
 - 2) Motor type and frame
 - 3) HP/BHP
 - 4) Phase, voltage, amperage, nameplate, actual, no load
 - 5) RPM
 - 6) Service factor
 - 7) Starter size, rating, heater elements

1.4 QUALITY ASSURANCE

- A. Contractor shall provide the services of a licensed independent contractor, certified by AABC, NEBB, or TABB and with proven experience on at least three similar projects, to perform operational testing, adjusting, and balancing of the air systems. The work shall be performed in

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accordance with the latest edition of the procedural standards as published by the National Organization associated with the testing, adjusting, and balancing contractor.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. All equipment shall be adjusted or balanced to meet the specified conditions and to operate at the elevation indicated in the equipment sections.

2.2 CONSTRUCTION

- A. Painting
 - 1. Surface finish damaged during cleaning, testing, adjusting, and balancing of equipment shall be repaired to the satisfaction of Engineer. Field painting shall be as specified in the Protective Coatings sections.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before testing and balancing the air system, doors and windows surrounding the area served by the system shall be closed. Fans shall be checked for correct rotation and rotative speed. Dampers shall be open and access doors and panels shall be closed during the testing and balancing period.

3.2 STARTUP REQUIREMENTS

- A. System equipment shall be subject to preliminary field tests as indicated in the Commissioning section.

3.3 FIELD PERFORMANCE TESTING

- A. Field performance tests shall be conducted for each system to demonstrate each is functioning as specified and to the satisfaction of Engineer. All tests shall be conducted in a manner acceptable to Engineer and shall be repeated as many times as necessary to secure Engineer's acceptance of each system. If inspection or tests indicate defects, the defective item or material shall be replaced, and the inspection and tests shall be repeated. All repairs to piping shall be made with new materials. Caulking of threaded joints or holes will not be acceptable.

Testing, Adjusting, and Balancing

3.4 CLEANING

- A. At the completion of the testing, all parts of the installation shall be thoroughly cleaned. All equipment, ductwork, pipes, valves, and fittings shall be cleaned of grease, debris, metal cuttings, and sludge. Any stoppage, discoloration, or other damage to parts of the building, its finish, or furnishings shall be repaired by Contractor at no additional cost to Owner.

3.5 ADJUSTING & BALANCING

- A. The air system shall be adjusted and balanced.
- B. All instrumentation shall be calibrated in accordance with the governing standard manual and shall be checked for accuracy before testing, adjusting, and balancing the systems. The accuracy of the instrumentation shall be not less than specified by the testing, adjusting, and balancing standard manual or the instrument manufacturer.
- C. All data, including system deficiencies encountered and corrective measures taken, shall be recorded. If a system cannot be adjusted to meet the design requirements, Contractor shall notify Engineer in writing as soon as practicable.
- D. Following final acceptance of the certified balancing reports, the testing and balancing contractor shall permanently mark the settings of all adjustment devices, including valves and dampers, and shall lock the memory stops.
- E. All ceiling tiles, belt guards, panels, and doors removed during testing, adjusting, and balancing shall be reinstalled.
- F. Air Systems
 - 1. Air systems shall be adjusted to the design airflows indicated on the Drawings. Airflows shall be adjusted to maintain a net positive (supply airflow greater than exhaust airflow) or negative (exhaust airflow greater than supply airflow) pressure as indicated on the Drawings. Dampers located behind air outlet and inlet devices shall be used to adjust the airflow only to the extent that the adjustments do not create objectionable air movement or noise. Fans shall not be adjusted above the maximum safe speed as determined by the fan manufacturer.
 - 2. Dampers with operators shall be checked for tight shutoff when in the closed position. Shutoff dampers shall not be used for balancing.

End of Section

Electrical

SECTION 26 05 11 - ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the furnishing and installation of all equipment and materials needed for the electrical requirements of this Contract. It also covers conduit, wiring, and terminations for electrical equipment installed under Electrical Equipment Installation section.
- B. This section covers the installation and interconnection of electrical equipment furnished under other sections, except electrical items designated to be installed under those sections.
- C. This section covers installation of equipment that has begun the procurement process by the Owner. The pre-selected equipment will be purchased by the Contractor.

1.2 GENERAL

- A. Electrical apparatus on all equipment shall be installed complete and placed in readiness for proper operation.
- B. Electrical materials furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- C. General Equipment Stipulations
 - 1. The General Equipment Stipulations section shall apply to all equipment provided under this section. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence
- D. Seismic Design Requirements
 - 1. Seismic design requirements for products specified herein shall be as indicated in the Contract Drawings.
- E. Coordination
 - 1. Electrical work shall conform to the construction schedule and the progress of other trades.
- F. Anchor Bolts and Expansion Anchors
 - 1. All anchor bolts, nuts, washers, and expansion anchors shall comply with Post Installed Anchors section, except smaller than 3/4 inch [19 mm] will be permitted to match NEMA standard size bolt holes on motors and electrical equipment.

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G. Drawings

1. Supplementing this section, the Drawings indicate locations of equipment and enclosures and provide one-line and schematic diagrams regarding the connection and interaction with other equipment.

1.3 CODES AND PERMITS

- A. All work shall be performed and materials shall be furnished in accordance with the NEC - National Electrical Code, the NESC - National Electrical Safety Code, and the following standards where applicable:

| | |
|----------|---|
| AEIC | The Association of Edison Illuminating Companies |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| AWG | American Wire Gauge |
| Fed Spec | Federal Specification |
| ICEA | Insulated Cable Engineers Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| IESNA | Illuminating Engineering Society of North America |
| NEIS | National Electrical Installation Standards |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| UL | Underwriters' Laboratories |

- B. Equipment covered by this section shall be listed by UL, or by a nationally recognized third party testing laboratory. All costs associated with obtaining the listing shall be the responsibility of Contractor. If no third-party testing laboratory provides the required listing, an independent test shall be performed at Contractor's expense. Before the test is conducted, Contractor shall submit a copy of the testing procedure to be used.

1.4 SEISMIC DESIGN REQUIREMENT.

A. Seismic Design Requirements

1. Submit confirmation of compliance with the requirements indicated on the Contract Drawings.

1.5 IDENTIFICATION.

A. Conduit

1. Conduits in manholes, handholes, building entrance pull boxes, junction boxes, and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel, with 1/2 inch stamped letters and numbers as indicated on the Drawings. Identification tags shall be stainless steel, shall be attached to conduits with wire or steel bands, and shall be positioned to be readily visible.

B. Conductors

1. All conductors in power, control, and instrumentation circuits shall be identified and color coded as described herein.
2. Conductor Identification Number
 - a. Except for lighting and receptacle circuits, each individual conductor in power, control, and instrumentation circuits shall be provided with wire identification markers at the point of termination.
 - b. The wire markers shall be Brady LS2000 labels without exception.
 - c. The wire numbers shall be as indicated on the equipment manufacturer's drawings.
 - d. The wire markers shall be positioned to be readily visible for inspection.
3. Conductor Color Coding
 - a. Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be the insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.
 - b. The following color coding system shall be used:
 - 1) 120/240V single-phase — black, red, and white
 - 2) 120/208V, three-phase — black, red, blue, and white
 - 3) 120/240V, three-phase — black, orange, blue, and white
 - 4) 277/480V, three-phase — brown, orange, blue, and gray
 - c. Where 120/240 and 120/208 volt systems share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.
 - d. Control and instrumentation circuit conductors shall be color coded as indicated in the Cable Data Figures at the end of this section.

C. Motor Starters

1. Motor starters shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.) as indicated on the Drawings. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened to the motor starters.

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D. Control Stations

1. Control stations shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.) as indicated on the Drawings. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened to the control stations.

E. Arc Flash Hazard Labels

1. Lighting panels, power panels, power centers, switchgear, switchboards, motor control centers, motor control line ups, transfer switches, industrial control panels, adjustable frequency drives, fused switches, meter socket enclosures, and other electrical equipment likely to be worked on energized shall be provided with permanent labels warning the risk of arc flash and shock hazard. Labels shall be designed in accordance with ANSI Z535.4 and shall include the following:

WARNING
Arc Flash and Shock Hazard

Appropriate personal protection equipment (PPE) required. SEE NFPA 70E. Equipment must be accessed by qualified personnel only.

Turn off all power sources prior to working on or inside equipment.

2. Additional information shall be provided on the labels where specified in the Arc Flash Hazard Analysis section of this section.

1.6 SUBMITTALS

A. Drawings and Data – General

1. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the work performed by the Contractor, shall be submitted in accordance with the Submittal Procedures section. The drawings and data shall include, but shall not be limited to, the following:
 - a. Drawings and data.
 - b. Operating manuals.
 - c. Samples.
 - d. Test reports
 - e. Studies

B. Submittal Details & Identification

1. Information covering all materials and equipment shall be submitted for review in accordance with the Submittal Procedures section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment as follows:

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- a. Lamp fixture descriptive sheets shall show the fixture schedule letter, number, or symbol for which the sheet applies.
- b. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies.
- c. Sheets or drawings covering more than the item being considered shall have all inapplicable information crossed out.
- d. A suitable notation shall identify equipment and materials descriptive literature not readily cross-referenced with the Drawings or Specifications.
- e. Schematics and connection diagrams for all electrical equipment shall be submitted for review. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted, unless it is clearly marked to show the intended connections.
- f. Surge protective device submittals shall include drawings (including unit dimensions, weights, component and connection locations, mounting provisions, and wiring diagrams), equipment manuals that detail the installation, operation and maintenance instructions for the specified unit(s), and manufacturer's descriptive bulletins and product sheets.

C. Engineering and Testing Firm

1. Contractor shall submit the name and qualifications of the Engineering and Testing Services firm proposed to perform the protective device study and the on-site testing.

D. Cable and Conduit Submittal

1. Within 90 days after the Notice to Proceed, Contractor shall furnish a submittal for all types of cable and conduit to be provided. The submittal shall include the cable manufacturer and type, and sufficient data to indicate that the cable and conduit meet the specified requirements.

E. Seismic Design Requirements

1. Submitted confirmation of compliance with the requirements as indicated on the Contract Drawings.

1.7 PROTECTION AND STORAGE

- A. During construction, the insulation on all electrical equipment shall be protected against absorption of moisture, and metallic components shall be protected against corrosion by strip heaters, lamps, or other suitable means. This protection shall be provided immediately upon receipt of the equipment and shall be maintained continuously.

PART 2 - PRODUCTS

2.1 CABLE

- A. All cables of each type shall be from the same manufacturer.

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- B. All types of cable shall conform to the Cable Data Figures at the end of this section and as described herein.
- C. 600 Volt Power Cable
 - 1. Cable in power, control, indication, and alarm circuits operating at 600 volts or less, except where multiconductor control, and instrument cables are required, shall be 600 volt (Figure 3-26 05 11 THHN-THWN) power cable.
- D. Instrument Cable
 - 1. Cable for electronic circuits to instrumentation, metering, and other signaling and control equipment shall be two- or three-conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield. Types of instrument cables shall be (Figure 4-26 05 11 single pair).

2.2 RACEWAY

- A. Conduit and cable tray shall be as described in the following paragraphs:

- 1. Liquidtight Flexible Metal Conduit
 - a. Liquidtight flexible metal conduit shall be hot-dip galvanized steel, shall be covered with a moistureproof polyvinyl chloride jacket, and shall be UL labeled.
- 2. Rigid Nonmetallic (PVC) Conduit
 - a. PVC conduit shall be heavy wall, Schedule 40, UL labeled for aboveground and underground uses, and shall conform to NEMA TC-2 and UL 651.
- 3. PVC-Coated Rigid Aluminum Conduit

The conduit shall be rigid aluminum. Before the PVC coating is applied, the hot-dip galvanized surfaces shall be coated with a primer to obtain a bond between the aluminum substrate and the coating. The PVC coating shall be bonded to the primed outer surface of the conduit. The bond on conduit and fittings shall be stronger than the tensile strength of the PVC coating. The thickness of the PVC coating shall be at least 40 mils.

A chemically cured two-part urethane coating, at a nominal 2 mil thickness, shall be applied to the interior of all conduit and fittings. The coating shall be sufficiently flexible to permit field bending the conduit without cracking or flaking of the coating.

Every female conduit opening shall have a PVC sleeve extending one conduit diameter or 2 inches, whichever is less, beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit before coating. The wall thickness of the sleeve shall be at least 40 mils.

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All fittings, condulets, mounting hardware, and accessories shall be PVC-coated. All hollow conduit fittings shall be coated with the interior urethane coating described above. The screw heads on condulets shall be encapsulated by the manufacturer with a corrosion-resistant material.

PVC coated rigid aluminum conduit shall be manufactured by Calbond, Ocal, or Robroy Industries.

4. Rigid Aluminum Conduit (RAC)
 - a. Rigid aluminum conduit and fittings shall be manufactured of 6063-T1 alloy, shall conform to ANSI C80.5, and shall be manufactured in accordance with UL 6A.

B. Cable Tray

1. Cable tray shall be aluminum constructed of AA-6063-T6 alloy. Electrical cable tray shall be in accordance with the requirements of NEMA VE 1. Cable trays shall be trough or ladder type construction as shown on the Drawings and/or as specified herein. Trough type tray shall be constructed with support provided over a minimum of 50 percent of its length for cable laid anywhere in the cable tray. Ladder type tray shall have a center-to-center rung spacing of 6 inches. Bolts, nuts, and pins for aluminum cable tray systems shall be 302, 304, or 316 stainless steel. All other hardware and accessories shall be of the same material as the tray.
2. All outdoor cable tray shall have solid aluminum covers with clamps.
3. The cable tray shall be capable of supporting loads as defined by NEMA VE 1 for load span class designations without failure or permanent distortion plus an additional 200 pound concentrated load placed at the mid-span of either side rail. The maximum longitudinal simple beam deflection for all cable trays shall be 0.35 inch at mid-span between 8 foot supports. The cable tray shall have the following NEMA VE 1 load span class designations.

| Cable Tray Size | NEMA Class |
|-----------------|------------|
| 4 x 12 | 12B |
| 6 x 12 | 12B |
| 4 x 18 | 12B |
| 6 x 18 | 12B |
| 4 x 24 | 12C |
| 6 x 24 | 12C |
| 4 x 36 | 12C |

4. The cable tray load factor (safety factor) shall be 1.5 in regard to destruction load tests in accordance with the requirements of NEMA VE 1 for the load span class designations noted above. This means that the destruction capacity of the tray furnished shall be 1.5

times the loading as listed in NEMA VE 1 for load span class designations for the various cable tray widths.

2.3 WIRING DEVICES, BOXES, AND FITTINGS

- A. Concealed conduit systems shall have flush-mounted switches and convenience outlets. Exposed conduit systems shall have surface-mounted switches and convenience outlets.
- B. Conduit Boxes and Fittings
 1. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be manufactured by Crouse-Hinds, Appleton, or O Z Gedney. In applications utilizing aluminum conduit systems, aluminum boxes and fittings manufactured by Crouse-Hinds, Appleton, or O Z Gedney shall be installed.
 2. Rigid PVC device boxes and fittings shall be manufactured by Carlon or Cantex.
 3. PVC coated device boxes shall be manufactured by Calbond, Ocal, or Robroy Industries.
 4. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement to avoid unnecessary bends and fittings.
- C. Device Plates.
 1. Galvanized or cadmium-plated device plates shall be used on surface mounted outlet boxes where weatherproof plates are not required.
 2. Device plates on flush mounted outlet boxes where weatherproof plates are not required shall be AISI Type 302 stainless steel, Eaton "93000 series", Hubbell "S series", or Leviton "840nn-40 series"; nylon or polycarbonate, Eaton "5000 series", Hubbell "Pn series", or Leviton "807nn-I series".
 3. Device plate mounting hardware shall be countersunk and finished to match the plate.
 4. Device plates for switches outdoors or indicated as weatherproof shall have provisions for padlocking switches "On" and "Off", and shall be Appleton "FSK-1VS", Crouse-Hinds "DS185" or O Z Gedney "FS-1-WSCA".
 5. Device plates for receptacles indicated as weatherproof shall be Appleton "FSK-WRD", Crouse-Hinds "WLRD1", or O Z Gedney "FS-1-WDCA".
 6. Flush-mounted, weatherproof plates shall be provided with adapter plates, Appleton "FSK-SBA" or Crouse-Hinds "FS031".
 7. Device plates for ground fault interrupter receptacles indicated to be weatherproof shall be Appleton "FSK-WGFI", Eaton "S966", or O Z Gedney "FS-1-GFCA".
 8. Receptacle covers outdoors or otherwise indicated to be weatherproof while in-use shall be die cast aluminum and shall include a padlock eye. Covers for standard convenience outlets shall be Hubbell "WP8M" or Thomas and Betts Red Dot "CKMUV". Covers for

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ground fault interrupter receptacles shall be Hubbell "WP26M" or Thomas and Betts Red Dot "CKMUV".

9. Engraved device plates, where required, shall be manufactured by Leviton, or equal.
10. Device plates on PVC conduit fittings shall be Carlon "E98 Series" or Cantex "513300 Series".

D. Wall Switches

1. Switches on ac lighting panel load circuits through 277 volts shall be 20 amperes, 120/277 volts, Eaton "AH1221V" through "AH1224V", Hubbell "HBL 1221I" through "HBL 1224I", or Leviton "1221-2I" through "1224-2I".
2. Switches for pulse control of lighting contactors shall be 20 amperes, 120/277 volts, momentary, double-throw, center "Off", Eaton "1995V", Hubbell "1557I" or Leviton "1257-I".
3. Switches on ac lighting panel load circuits through 277 volts in Class I, Division 1 and Division 2, Group D hazardous areas indicated on the Drawings shall be 20 ampere, 120/277 volts. Hazardous area switches shall be factory sealed tumbler switches, Appleton "EDS" or Killark "FXS".

E. Receptacles

1. Standard convenience outlets shall be duplex, three-wire, grounding, 20 amperes, 125 volts, Eaton "AH5362V", Hubbell "5362I" or Leviton "5362-I" for 120 volt circuits, and 250 volts, Eaton "AH5462CV", Hubbell "5462I" or Leviton "5462-I" for 240 volt circuits.
2. Ground fault circuit interrupter receptacles shall be duplex, 20 amperes, 125 volts, Eaton "SGFH20", Hubbell "GFRST20I" or Leviton "G5362-I".
3. Ground fault circuit interrupter receptacles in damp or wet locations shall be duplex, 20 amperes, 125 volts, Hubbell "GFWRST20I" or Leviton "G5362-WTI".
4. 600 volt welding receptacles shall be 30 amperes, 3 phase, with grounding conductors connected through a fourth pole, Appleton "ADRE3034-100", Crouse-Hinds "AR348" plus "ARRC33" and "AR30" or Leviton "430MI5W". One matching plug, Appleton "ACP3034BC", Crouse-Hinds "APJ3485" or Leviton "430P5W" with appropriate woven grip and plug cap, shall be furnished for the cable size directed by Owner.
5. 240 volt welding receptacles shall be 60 amperes, 3 phase, with grounding conductors connected through a fourth pole, Appleton "ADRE6034-150", Crouse-Hinds "AREA6425" or Leviton "460MI9W". One matching plug, Appleton "ACP6034BC", Crouse-Hinds "APJ6485" or Leviton "460P9W" with appropriate woven grip and plug cap, shall be furnished for the cable size directed by Owner.
6. Receptacles in Class I, Division 1 and Division 2, Group D hazardous areas indicated on the Drawings shall be three-wire, grounding, 20 amperes, 125 volts. Hazardous area

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receptacles shall be factory sealed, with an integral switch that is only activated when an approved matching plug is fully inserted and rotated into the engaged position. Hazardous area receptacles shall be Appleton "ENR", Crouse-Hinds "ENR", or Killark "UGR".

F. Special Outlets

1. Clock outlets shall be Hubbell "5235" or Leviton "5261-CH".

2.4 JUNCTION BOXES, PULL BOXES, AND WIRING GUTTERS

- A. Junction boxes (larger than switch, receptacle, or fixture type) and gutters shall be NEMA Type 4X stainless steel and shall be rigidly supported by PVC coated or stainless steel framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.
- B. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 lbs, shall have rigid handles. Covers larger than 3 by 4 feet shall be split.
- C. Where indicated on the Drawings, junction and pull boxes with a removable side opposite the underground conduits shall be provided over building ends of underground conduit banks. Boxes shall be sized in accordance with the National Electrical Code, including space for full size continuations of all underground conduits not originally continued. Conduit arrangement shall leave maximum space for future conduits.

2.5 LIGHTING FIXTURES

- A. Lighting fixtures shall be furnished as described in the fixture schedule and as indicated on the Drawings. Lighting fixtures shall be furnished complete with lamps. Pendant fixtures shall have swivel type box covers and threaded conduit pendants unless otherwise specified. Lighting fixtures shall be provided with disconnects in accordance with NEC requirements.
- B. Electronic Drivers
 1. Electronic drivers furnished with LED type lighting fixtures shall be certified as meeting requirements of ANSI C82.77 with a THD level of not more than 20 percent.

2.6 POWER PANELS

- A. Unless otherwise specified, each power panel, without a neutral, shall be dead-front, 3 phase panelboard with circuit breakers, in accordance with the Drawings and the following:
- B. Cabinet
 1. The panel shall have a flush-mounted or surface-mounted enclosure with a NEMA 4X stainless steel enclosure. The enclosure shall have a door with latch and lock. At the completion of the Contract, a neatly printed or typed directory listing the panel and circuit identities shall be mounted inside the door.

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C. Circuit Breakers

1. Circuit breakers shall be thermal-magnetic, bolt-in, individually front replaceable, and shall indicate "On", "Off", and "Tripped". Breakers indicated as multiple-pole shall be common trip type. Breakers for 480 volts shall be rated 600 volts, with interrupting ratings not less than 65,000 amperes at 480 volts. Handle clips to prevent casual operation of breakers shall be provided for 10 percent (at least two) of the breakers and applied to the circuits directed.

D. Buses

1. The panel shall have 3 phase buses and a ground bus. Buses shall be copper, with ampere and voltage ratings and main lugs or breakers as indicated. The ground bus shall be similar to a neutral bus and shall have a good ground connection to the cabinet, clamp type lugs for the ground cable in each supply conduit, and connections for a ground cable in each load conduit.

2.7 SURGE PROTECTIVE DEVICES

A. Scope

1. Surge protective devices (SPD) shall be provided as specified herein and as indicated on the Drawings. Each unit shall be designed for parallel connection to the wiring system and shall utilize non-linear voltage-dependent metal oxide varistors (MOV) in parallel.
2. Each SPD shall be furnished and installed for the electrical equipment indicated on the Drawings or as specified herein. All new lighting and power panels shall be furnished with an integral SPD.
3. Power panels shall have SPDs rated for a medium-high exposure levels.

B. Standards

1. The specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:
 - a. ANSI/IEEE C62.41 and C62.45;
 - b. ANSI/IEEE C62.1 and C62.11;
 - c. IEEE C62.62;
 - d. National Electrical Manufacturers Association (NEMA LS1 Guidelines);
 - e. National Fire Protection Association (NFPA 20, 70 [NEC], 75, and 780);
 - f. Underwriters Laboratories UL 1449 and 1283
2. The unit shall be UL 1449 Listed as a Type 2 Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference (EMI) Filter.

C. Environmental Requirements

1. Operating Temperature: 0°F to +140°F .

2. Relative Humidity: Reliable operation with 5 percent to 95 percent non-condensing.

D. Electrical Requirements

1. Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the Drawings.
2. Maximum Continuous Operating Voltage (MCOV). The SPD shall be designed to withstand a MCOV of not less than 115 percent of nominal RMS voltage.
3. Operating Frequency. Operating frequency range shall be 47 to 63 Hertz.
4. Protection Modes. Four-wire configured systems shall provide, Line-to-Neutral (L-N), Line-to-Ground (L-G), and Neutral-to-Ground (N-G), and Line-to-Line (L-L) protection. Three-wire configured systems shall provide, Line-to-Line (L-L) protection and Line-to-Ground (L-G) protection.
5. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be as required and shall be no less than listed in the following table.

| | L-N | L-G | N-G | L-L |
|----------------------------|--------|--------|--------|--------|
| Medium-High Exposure Level | 100 kA | 100 kA | 100 kA | 100 kA |

6. UL 1449 Voltage Protection Rating (VPR). The maximum VPR per mode for the device (inclusive of disconnect) shall be as required and shall not exceed the following:

| Voltage | L-N | L-G | N-G | L-L |
|----------|-----|--------|-----|--------|
| 480 V 3W | | 1200 V | | 2000 V |

7. Noise Attenuation. The unit shall be capable of a minimum -30 dB attenuation at 100kHz when tested per the 50 ohm insertion loss method as defined by MIL-STD-220C.
8. Nominal Discharge Current. Each SPD shall have a nominal discharge current rating of 20 kA.
9. Overcurrent Protection. At high and medium-high exposure levels, the SPD shall incorporate internal fusing capable of interrupting, at minimum, up to 200 kA symmetrical fault current with 600 volts ac applied.

At medium and low exposure levels, the SPD shall incorporate internal fusing capable of interrupting, at minimum, up to 65kA symmetrical fault current with 600 volts ac applied.

The device shall be capable of allowing passage of the rated maximum surge current for every mode without fuse operation.

10. Unit Status Indicators. The unit shall include long-life, externally visible phase indicators that monitor the on-line status of the unit. When furnished integral to the panelboard, the status indicators shall be viewable when the panelboard door is opened.

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E. Installation

1. Each SPD shall be installed according to the manufacturer's recommendations. If possible for the integral units, provide direct bus connections.

F. Miscellaneous

1. Disconnect Switch. Each SPD shall be furnished with an integral disconnect switch. The unit shall be UL 1449 listed as such, and the UL 1449 Voltage Protection Ratings shall be provided. The disconnect switch shall be fused and capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.
2. Enclosure. For the SPD units to be mounted externally of the protected electrical equipment, provide NEMA rated enclosures suitable for the locations indicated on the Drawings.
3. Dual Form "C" Dry Contacts. The SPD shall be provided with a set of form "C" dry contacts (normally open and normally closed) to facilitate connection to a plant control system or other remote monitoring system. The contacts shall be normally open or normally closed and shall change state upon any alarm condition.

G. Acceptable Manufacturers

1. Integral SPD's shall be manufactured by Eaton, General Electric, or Schneider-Electric. External SPD's shall be manufactured by Eaton, General Electric, Siemens Energy & Automation, Schneider-Electric, or Current Technology. The products of other manufacturers will not be acceptable.

2.8 DISCONNECT SWITCHES

- A. Unless otherwise specified, each disconnect switch shall be 3 pole, nonfusible, 600 volts, with a continuous current rating as indicated on the Drawings.
- B. Where indicated on the Drawings, fused switches shall be furnished complete with fuses. Fuse sizing shall be as indicated on the Drawings, as required by the results of the protective device study, or as recommended by the respective protected equipment manufacturer.
- C. Switches shall have NEMA type enclosure designations suitable for the environment in which they are installed. Switches shall have minimum NEMA Type 4X stainless steel enclosures.
- D. Switches shall have high conductivity copper, visible blades; nontearable, positive, quick-make, quick-break mechanisms; and switch assembly plus operating handle as an integral part of the enclosure base. Each switch shall have a handle whose position is easily recognizable and which can be locked in the "Off" position with three padlocks. The "On" and "Off" positions shall be clearly marked.
- E. All switches shall be UL listed and horsepower rated, and shall meet the latest edition of NEMA KS1. Switches shall have defeatable door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

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2.9 LIGHTING AND AUXILIARY POWER TRANSFORMERS

- A. Separately mounted transformers shall be provided in the phases, kVA, and voltages indicated on the Drawings. Transformers shall be self-air-cooled, dry type, wall- or floor-mounted, and enclosed for wiring in conduit. Transformers installed outdoors shall be weatherproof. Transformers shall have at least four full capacity voltage taps, two above and two below rated voltage. Transformers shall meet DOE 10 CFR 431 guidelines for energy efficiency.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

- A. All material, equipment, and components specified herein shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

3.2 CABLE INSTALLATION

A. General

B. Except as otherwise specified or indicated on the Drawings, cable shall be installed according to the following procedures, taking care to protect the cable and to avoid kinking the conductors, cutting or puncturing the jacket, contamination by oil or grease, or any other damage. Circuits to supply electric power and control to equipment and devices, communication and signal circuits as indicated on the one-line diagrams shall be installed continuous and may not be spliced unless approved by the Engineer.

1. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.
2. Stranded conductor cable shall be spliced by crimp type connectors. Twist-on wire connectors may only be used for splicing solid cable and for terminations at lighting fixtures.
3. Splices may be made only at readily accessible locations.
4. Cable terminations and splices shall be made as recommended by the cable manufacturer for the particular cable and service conditions.
5. Cable shall not be pulled tight against bushings nor pressed heavily against enclosures.
6. Cable-pulling lubricant shall be compatible with all cable jackets; shall not contain wax, grease, or silicone; and shall be Polywater "Type J".
7. Where necessary to prevent heavy loading on cable connections, in vertical risers, the cable shall be supported by Kellems, or equal, woven grips.
8. Spare cable ends shall be taped, coiled, and identified.
9. Cables shall not be bent to a radius less than the minimum recommended by the manufacturer. For cables rated higher than 600 volts, the minimum radius shall be 8 diameters for nonshielded cable and 12 diameters for shielded cable.
10. All cables in one conduit, over 1 foot long, or with any bends, shall be pulled in or out simultaneously.
11. Circuits to supply electric power and control to equipment and devices are indicated on the one-line diagrams. Conductors in designated numbers and sizes shall be installed in conduit of designated size. Circuits shall not be combined to reduce conduit requirements unless acceptable to Engineer.
12. Instrument cable shields and drain wires shall be continuous over the entire length of the circuit and grounded at one end only. In general, the field end of the shield shall be ungrounded. At the ungrounded termination of the circuit, the shield and drain wire shall be insulated by taping to prevent grounding.

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C. Underground Cable Pulling Procedure

1. Care shall be taken to prevent excessive physical stresses that would cause mechanical damage to cables during pulling.

3.3 RACEWAY INSTALLATION

A. Contractor shall be responsible for routing all raceway. This shall include all conduits indicated on the one-lines, riser diagrams, and home-runs shown on the plan Drawings. Conduits shall be routed as defined in these Specifications. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.

B. Except as otherwise specified or indicated on the Drawings, conduit installation and identification shall be completed according to the following procedures.

C. Installation of Interior and Exposed Exterior Conduit

1. This section covers the installation of conduit inside structures, above and below grade, and in exposed outdoor locations. In general, conduit inside structures shall be concealed. Large conduit and conduit stubs may be exposed unless otherwise specified or indicated on the Drawings. No conduit shall be exposed in water chambers unless so indicated on the Drawings.
2. Unless otherwise indicated on the Drawings, Contractor shall be responsible for routing the conduit to meet the following installation requirements:
 - a. Conduit installed in all exposed indoor locations, except corrosive areas indicated on the Drawings, and in floor slabs, walls, and ceilings of hazardous (classified) locations, shall be rigid aluminum. Exposed conduit shall be rigidly supported by stainless steel hardware and framing materials, including nuts and bolts.
 - b. Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 40 PVC.
 - c. Final connections to dry type transformers, to motors without flexible cords, and to other equipment with rotating or moving parts shall be liquidtight flexible metal conduit with watertight connectors installed without sharp bends and in the minimum lengths required for the application, but not longer than 6 feet unless otherwise acceptable to Engineer.
 - d. Terminations and connections of rigid aluminum conduit shall be taper threaded. Conduits shall be reamed free of burrs and shall be terminated with conduit bushings.
 - e. Exposed conduit shall be installed either parallel or perpendicular to structural members and surfaces.
 - f. Two or more conduits in the same general routing shall be parallel, with symmetrical bends.

Electrical

- g. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues.
- h. Rigid Schedule 40 and 80 PVC conduit shall have supports and provisions for expansion as required by NEC Article 352.
- i. Metallic conduit connections to sheet metal enclosures shall be securely fastened by locknuts inside and outside.
- j. Rigid Schedule 40 and 80 PVC conduit shall be secured to sheet metal device boxes using a male terminal adapter with a locknut inside or by using a box adapter inserted through the knockout and cemented into a coupling.
- l. Conduits in walls or slabs, which have reinforcement in both faces, shall be installed between the reinforcing steel. In slabs with only a single layer of reinforcing steel, conduits shall be placed under the reinforcement. Conduits larger than 1/3 of the slab thickness shall be concrete encased under the slab.
- m. Conduits that cross structural joints where structural movement is allowed shall be fitted with concretetight and watertight expansion/deflection couplings, suitable for use with metallic conduits and rigid Schedule 40 or 80 PVC conduits. The couplings shall be Appleton Type DF, Crouse-Hinds Type XD, or O-Z Type DX.
- n. Conduit shall be clear of structural openings and indicated future openings.
- o. Conduits through roofs or metal walls shall be flashed and sealed watertight.
- p. Conduit installed through any openings cut into non-fire rated concrete or masonry structure elements shall be neatly grouted. Conduit penetrations of fire rated structure elements shall be sealed in a manner that maintains the fire rating as indicated on the Architectural Drawings.
- q. Conduits shall be capped during construction to prevent entrance of dirt, trash, and water.
- r. Exposed conduit stubs for future use shall be terminated with aluminum pipe caps.
- s. Concealed conduit for future use shall be terminated in equipment or fitted with couplings plugged flush with structural surfaces.
- t. Where the Drawings indicate future duplication of equipment wired hereunder, concealed portions of conduits for future equipment shall be provided.

Electrical

- u. Horizontal conduit shall be installed to allow at least 7 feet of headroom, except along structures, piping, and equipment or in other areas where headroom cannot be maintained.
- v. Conduit shall not be routed across the surface of a floor, roof, or walkway unless approved by Engineer.
- x. PVC-coated rigid aluminum conduit shall be threaded and installed as recommended by the conduit manufacturer's installation procedure using appropriate tools.
- y. All conduits that enter enclosures shall be terminated with acceptable fittings that will not affect the NEMA rating of the enclosure.
- z. Conduit which turns out of concrete slabs or walls, shall be connected to a 90 degree elbow of PVC-coated rigid aluminum conduit before it emerges. Conduits shall have PVC-coated rigid aluminum coupling embedded a minimum of 3 inches when emerging from slabs or walls and the coupling shall extend 2 inches from the wall.

D. Underground Conduit Installation

1. All excavation, backfilling, and concrete work shall conform to the respective sections of these Specifications. Underground conduit shall conform to the following requirements:
 - a. All underground conduits shall be concrete encased unless indicated otherwise on the Drawings. Concrete encasement within 15 feet of building entrances, under and within 5 feet of roadways, and within 10 feet of indicated future excavations shall be reinforced as detailed on the Drawings.
 - b. Concrete encased conduit shall be schedule 40 PVC. Conduits shall have PVC-coated rigid aluminum coupling embedded a minimum of 3 inches when emerging from walls and the coupling shall extend 2 inches from the wall. All PVC joints shall be solvent welded in accordance with the recommendations of the manufacturer.
 - c. Concrete encasement on exposed outdoor conduit risers shall continue to 6 inches above grade, with top crowned and edges chamfered.
 - d. Conduit and concrete encasement installed underground for future extension shall be terminated flush at the bulkhead with a coupling and a screw plug. The termination of the duct bank shall be reinforced with bars 100 diameters long that shall be terminated 2 inches from the bulkhead. Matching splice bars shall be 50 bar diameters long. Each longitudinal bar shall be provided with a Lenton "Form Saver" coupler and plate or a Dayton "Superior DBR" coupler at the bulkhead. The coupler shall be threaded to accept a dowel of like diameter in the future. Threads shall be protected with screw-in plastic caps. A 1-3/4 by 3/4 inch deep horizontal shear key shall be formed in the concrete encasement above and below the embedded conduits. After concrete placement, conduit and bar connector ends shall be cleaned and coated with two coats of thixotropic coal tar.
 - e. Underground conduits indicated not to be concrete encased shall be rigid Schedule 40 PVC.

Electrical

- f. Underground conduit bend radius shall be at least 2 feet at vertical risers and at least 3 feet elsewhere.
- g. Underground conduits and conduit banks shall have at least 2 feet of earth cover, except where indicated otherwise.
- h. Underground conduit banks through building walls shall be cast in place, or concreted into boxouts, with water stops on all sides of the boxout. Water stops are specified in the Cast-In-Place Concrete section.
- i. Underground nonmetallic conduits, which turn out of concrete or earth in outdoor locations, shall be connected to 90 degree elbows of PVC-coated rigid aluminum conduit before they emerge.
- j. Conduits not encased in concrete and passing through walls, which have one side in contact with earth, shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.
- k. Underground conduits shall be sloped to drain from buildings to manholes.
- l. Intercommunication and instrument cables shall be separated the maximum possible distance from all power wiring in pull-boxes, manholes, and handholes.

E. Sealing of Conduits

1. After cable has been installed and connected, conduit ends shall be sealed by forcing nonhardening sealing compound into the conduits to a depth at least equal to the conduit diameter. This method shall be used for sealing all conduits at handholes, manholes, and building entrance junction boxes, and for 1 inch and larger conduit connections to equipment.

F. Reuse of Existing Conduits

1. Existing conduits may be reused subject to the concurrence of Engineer and compliance with the following requirements:
 - a. A wire brush shall be pulled through the conduit to remove any loose debris.
 - b. A mandrel shall be pulled through the conduit to remove sharp edges and burrs.

3.4 WIRING DEVICES, BOXES, AND FITTINGS INSTALLATION

A. Metallic and nonmetallic conduit boxes and fittings shall be installed in the following locations:

B. Conduit Boxes and Fittings

1. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be installed in concrete walls, ceilings, and floors; in the outdoor faces of masonry walls; and in all locations where weatherproof device covers are required. These boxes and fittings shall also be installed in exposed rigid steel and intermediate metal conduit systems.
2. Galvanized or cadmium plated sheet steel boxes shall be installed in the indoor faces of masonry walls, in interior partition walls, and in joist supported ceilings.
3. Rigid PVC device boxes shall be installed in exposed nonmetallic conduit systems.

Electrical

4. PVC coated boxes and fittings shall be installed in PVC coated conduit systems.

C. Device Plates

1. Oversized plates shall be installed where standard-sized plates do not fully cover the wall opening.

D. Wall Switches

1. Wall switches shall be mounted 3'-6" above floor or grade.
2. After circuits are energized, all wall switches shall be tested for proper operation.

E. Receptacles

1. Convenience outlets shall be 4 feet above the floor unless otherwise required.
2. After circuits are energized, each receptacle shall be tested for correct polarity and each GFCI receptacle shall be tested for proper operation.
3. Conduit and wire for convenience outlet installation is not shown on the Drawings and shall be sized, furnished, and installed by Contractor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for convenience outlet installation.

F. Special Outlets

1. Wall thermostats shall be 4'-6" above the floor unless otherwise required. Thermostats on exterior walls shall be suitably insulated from wall temperature.

3.5 EQUIPMENT INSTALLATION

- A. Except as otherwise specified or indicated on the Drawings, the following procedures shall be used in performing electrical work.

B. Setting of Equipment

1. All equipment, boxes, and gutters shall be installed level and plumb. Boxes, equipment enclosures, metal raceways, and similar items mounted on water- or earth-bearing walls shall be separated from the wall by at least 1/4 inch thick corrosion-resistant spacers. Where boxes, enclosures, and raceways are installed at locations where walls are not suitable or available for mounting, concrete equipment pads, framing material, and associated hardware shall be provided.

C. Sealing of Equipment

1. All outdoor substation, switchgear, motor control center, and similar equipment shall be permanently sealed at the base, and all openings into equipment shall be screened or sealed with concrete grout to keep out rodents and insects the size of wasps and mud daubers. Small cracks and openings shall be sealed from inside with silicone sealant, Dow-Corning "795" or General Electric "SCS1200".

3.6 GROUNDING

A. General

1. The electrical system and equipment shall be grounded in compliance with the National Electrical Code and the following requirements:
 - a. All ground conductors shall be at least 12 AWG soft drawn copper cable or bar, bare or green-insulated in accordance with the National Electrical Code.
 - b. Ground cable splices and joints, ground rod connections, and equipment bonding connections shall meet the requirements of IEEE 837, and shall be exothermic weld connections or irreversible high-compression connections, Cadweld "Exothermic" or Burndy "Hyground". Mechanical connectors will not be acceptable. Cable connections to bus bars shall be made with high-compression two-hole lugs.
 - c. Ground cable through exterior building walls shall enter within 3 feet below finished grade and shall be provided with a water stop. Unless otherwise indicated, installation of the water stop shall include filling the space between the strands with solder and soldering a 12 inch copper disc over the cable. The copper disc shall be installed on the exterior of the wall and shall be a minimum thickness of 12 gauge and have a diameter that is a minimum of 2 inch larger than the diameter of the core hole that the ground cable passes through. The copper disc shall be soldered to the ground cable and caulk shall be applied around the outside edge of the copper disc where it adjoins the exterior wall. Caulk rated for submerged application shall comply with the Joint Sealants section.
 - d. Ground cable near the base of a structure shall be installed in earth and as far from the structure as the excavation permits, but not closer than 24 inches . The tops of ground rods and ground cable interconnecting ground rods shall be buried a minimum of 30 inches below grade, or below the frost line, whichever is deeper.
 - e. All powered equipment, including lighting fixtures and receptacles, shall be grounded by a copper ground conductor in addition to the conduit connection.
 - f. Ground connections to equipment and ground buses shall be made with copper or high conductivity copper alloy ground lugs or clamps. Connections to enclosures not provided with ground buses or ground terminals shall be made with irreversible high-compression type lugs inserted under permanent assembly bolts or under new bolts drilled and inserted through enclosures, other than explosion proof enclosures, or by grounding locknuts or bushings. Ground cable connections to anchor bolts; against gaskets, paint, or varnish; or on bolts holding removable access covers will not be acceptable.
 - g. The grounding system shall be bonded to the station piping by connecting to the first flange inside the building, on either a suction or discharge pipe, with a copper bar or strap. The flange shall be drilled and tapped to provide a bolted connection.

Electrical

- h. Ground conductors shall be routed as directly as possible, avoiding unnecessary bends. Ground conductor installations for equipment ground connections to the grounding system shall have turns with minimum bend radii of 12 inches.
- i. Ground rods not described elsewhere shall be a minimum of 3/4 inch in diameter by 10 feet long, with a copper jacket bonded to a steel core.
- j. Test wells and covers for non-traffic areas shall be molded high density polyethylene. Test wells for traffic areas shall be precast concrete construction rated for traffic duty with concrete or cast iron covers.

B. Grounding System Resistance

- 1. The ground system resistance shall comply with National Electrical Code.

C. Grounding System Testing

- 1. The grounding system of each new building or structure and each existing building or structure indicated below, shall be tested to determine the resistance to earth. Testing shall be performed by an independent electrical or grounding system testing organization. Testing shall be completed after not less than three full days without precipitation and without any other moistening or chemical treatment of the soil.
- 2. New Grounding Systems
 - a. Grounding systems of each new building or structure shall be tested for resistance to earth utilizing the three-point fall of potential test as defined by IEEE 81. Testing shall be completed prior to installation of the electrical distribution equipment to ensure the grounding system is isolated from the utility grounding system and the systems of other structures. The current source probe for the test shall be placed in soil at a distance of 5 to 10 times the distance of the widest measurement across the grounding system ring or grid to ensure adequate measurements outside of the grounding system's sphere of influence. Test probe measurements shall be taken at a distance of one foot from the grounding system reference connection and at each 10 percent increment from the grounding system reference connection to the current source probe location. Test results shall be documented on a graphical plot with resistance in ohms on the vertical axis and distance in feet on the horizontal axis. The results shall clearly indicate a system resistance plateau which confirms a valid test procedure.
- 3. Grounding System Test Report
 - a. A report certified by the testing organization shall be prepared and submitted in accordance with the Submittal Procedures section. The final report shall include complete testing results for each building or structure, graphical representation of the test point results for the three-point fall of potential method, and complete observations of all site weather conditions and other environmental conditions that may affect the test results. Final acceptance of the results reported shall be subject to the review and approval of Engineer.

3.7 LIGHTING FIXTURE INSTALLATION

- A. The Drawings indicate the general locations and arrangements of the lighting fixtures. Fixtures in rows shall be aligned both vertically and horizontally unless otherwise specified. Fixtures shall be clear of pipes, mechanical equipment, structural openings, indicated future equipment and structural openings, and other obstructions.
- B. Conduit and wire for lighting fixture installation is not shown on the Drawings and shall be sized, furnished and installed by Contractor. Circuits to emergency lighting units, exit signs, and fixtures indicated to be night lights shall not be switched. Circuits to lighting fixtures indicated to have emergency battery packs shall include an additional un-switched hot conductor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for lighting fixture installation.

3.8 MODIFICATIONS TO EXISTING EQUIPMENT

- A. Modifications to existing equipment shall be completed as specified herein and indicated on the Drawings. All existing facilities shall be kept in service during construction. Temporary power or relocation of existing power and control wiring, equipment, and devices shall be provided as required during construction. Coordination and timing of outages shall be as specified in other sections of these Specifications. Electrical power interruptions will only be allowed where agreed upon in advance with Owner, and scheduling at times of low demand may be required.
- B. Demolition
 - 1. Unless otherwise specified or indicated on the Drawings, all cable and all exposed conduit for power and control signals of equipment indicated to be removed shall be demolished. Conduit supports and electrical equipment mounting hardware shall be removed, and holes or damage remaining shall be grouted or sealed flush. Conduit partially concealed shall be removed where exposed, and plugged with expanding grout flush with the floor or wall. Repairs shall be refinished to match the existing surrounding surfaces. Demolished equipment shall be discarded or salvaged as indicated on the Drawings and as specified in other sections of these Specifications.
 - 2. Existing UV systems shall be disconnected and discarded except where indicated on the Drawings. Cables marked for demolition on the Drawings shall be cut and removed, existing ductbank shall not be demolished.

Existing circuit breakers not being reused under the scope of this work shall be marked as "Spare". Existing circuit breakers in Unit Substation No. 4 and Unit Substation No. 7 being reused to feed new electrical equipment shall be marked according to their respective updated load tagging.

End of Section

Electrical

STANDARD SPECIFICATIONS

REFERENCE: UL 83, ICEA S-95-658 (NEMA WC 70).
 CONDUCTOR: Stranded, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.
 INSULATION: Polyvinyl chloride, UL 83, Type THHN and THWN, ICEA S-95-658.
 SHIELD: None.
 JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 83.
 FACTORY TESTS: Cable shall meet the requirements of UL 83 for Type THHN and THWN.

Cable Details

| Size | | Number of Strands | Conductor Insulation Thickness* | | Maximum Outside Diameter | |
|--------------|-----------------|-------------------|---------------------------------|------|--------------------------|-------|
| AWG or kcmil | mm ² | | in. | μm | in. | mm |
| 14 | 2.5 | 19 | 0.015 | 381 | 0.12 | 3.05 |
| 12 | 4.0 | 19 | 0.015 | 381 | 0.14 | 3.56 |
| 10 | 6.0 | 19 | 0.020 | 508 | 0.17 | 4.32 |
| 8 | 10.0 | 19 | 0.030 | 762 | 0.23 | 5.84 |
| 6 | 16.0 | 19 | 0.030 | 762 | 0.26 | 6.60 |
| 4 | 25.0 | 19 | 0.040 | 1016 | 0.33 | 8.38 |
| 2 | 35.0 | 19 | 0.040 | 1016 | 0.39 | 9.91 |
| 1 | 40.0 | 19 | 0.050 | 1270 | 0.44 | 11.18 |
| 1/0 | 50.0 | 19 | 0.050 | 1270 | 0.50 | 12.70 |
| 2/0 | 70.0 | 19 | 0.050 | 1270 | 0.54 | 13.72 |
| 4/0 | 95.0 | 19 | 0.050 | 1270 | 0.66 | 16.76 |
| 250 | 120.0 | 37 | 0.060 | 1520 | 0.72 | 18.29 |
| 350 | 185.0 | 37 | 0.060 | 1520 | 0.83 | 21.08 |
| 500 | 300.0 | 37 | 0.060 | 1520 | 0.96 | 24.38 |
| 750 | 400.0 | 61 | 0.070 | 1780 | 1.17 | 29.72 |
| 1,000 | 500.0 | 61 | 0.070 | 1780 | 1.32 | 33.53 |

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, THWN or THHN, conductor size, and 600 volt.

600 Volt, Single Conductor Power Cable (600-1-PVC-THHN-THWN)

BLACK & VEATCH

Cable Data

Figure 3 - 26 05 11

| STANDARD SPECIFICATIONS | | | | |
|--|--|-----------|---------------------------------|-----------|
| REFERENCE: | UL 66, UL 1277. | | | |
| CONDUCTOR: | 16 AWG (1.5 mm ²), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet. | | | |
| INSULATION: | Polyvinyl chloride, not less than 15 mils (380 μm) average thickness; 13 mils (330 μm) minimum thickness, UL 66, Type TFN. | | | |
| LAY: | Twisted pair with 1-1/2 inch to 3 inch (38.10 mm - 63.5 mm) lay. | | | |
| SHIELD: | Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm ²) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors. | | | |
| JACKET: | Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 66. Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core. | | | |
| CONDUCTOR IDENTIFICATION: | One conductor black, one conductor white. | | | |
| FACTORY TESTS: | Insulated conductors shall meet the requirements of UL 66 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277. | | | |
| Cable Details | | | | |
| | Assembly Jacket Thickness* | | Maximum Outside Diameter | |
| | in. | μm | in. | mm |
| Single Pair | 0.045 | 1140 | 0.34 | 8.64 |
| <p>*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the value indicated above.</p> <p>A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type TFN, conductor size, single pair, and voltage class.</p> | | | | |
| 600 Volt, Single Pair, Shielded Instrument Cable (600-SINGLE-PAIR-SH-INSTR) | | | | |
| BLACK & VEATCH | Cable Data | | Figure 4 - 26 05 11 | |

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Electrical Equipment Installation

SECTION 26 05 83 - ELECTRICAL EQUIPMENT INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the installation of electrical equipment.

1.2 GENERAL

- A. Equipment specified to be installed under this section shall be erected, and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. The electrical equipment identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.
- C. Coordination
 - 1. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 14 days prior to the need for manufacturer's field services furnished by others.
 - 2. Submittals for equipment furnished under the original procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery

- 1. When sills are required for electrical equipment, they shall be shipped ahead of the scheduled equipment delivery to permit installation before concrete is placed.

B. Storage

- 1. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with Product Storage and Handling Requirements section, and in accordance with manufacturer's written instructions, until installed in the Work. Equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on earth or grass surfaces or come

Electrical Equipment Installation

into contact with earth or grass. Contractor shall keep the equipment clean and dry at all times. Openings shall be plugged or capped (or otherwise sealed by packaging) during temporary storage.

C. Handling

1. Electrical equipment shall be moved by lifting, jacking, or skidding on rollers as described in the manufacturer's instructions. Special lifting harness or apparatus shall be used when required. Lifting and jacking points shall be used when identified on the equipment. Contractor shall have required unloading equipment on site to perform unloading work on the date of equipment delivery.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

- A. All installation work shall be in accordance with manufacturer's written instructions.
- B. All material, equipment, and components specified to be installed according to this section shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.
- C. Electrical equipment cubicles and vertical sections shall be installed plumb and level. Drawout equipment carriages, circuit breakers, and other removable components shall operate free and easy without binding or distortion.
- D. Unless otherwise indicated or specified, all indoor floor-mounted electrical equipment and control cabinets shall be installed on concrete equipment pads four inches [102 mm] in height.
- E. Indoor metalclad switchgear shall be bolted to steel floor channels which are installed level and flush with the top of the concrete floor or equipment pad.
- F. Outdoor metalclad switchgear and interrupter gear with integral floor channels or beams shall be secured to concrete pads with anchor bolts and clips.
- G. Motor control centers with integral floor sills shall be secured to concrete floors or equipment pads with anchor bolts.
- H. Adequate bracing shall be provided for seismic forces. The bracing shall be designed to meet the requirements as indicated on the Contract Drawings.
- I. Cleaning

Electrical Equipment Installation

1. All deposits of oil, grease, mud, dirt or debris shall be cleaned from the electrical equipment following installation and field wiring. A detergent water based solution, or other liquid cleaners not harmful to material or equipment finishes, shall be used as recommended by the manufacturer.

End of Section

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SECTION 26 41 13 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers furnishing the design of lightning protection systems and the furnishing and installation of lightning protection equipment for the following structures:
 - 1. UV Building
- B. Lightning protection systems shall be furnished, installed, and tested as specified. Lightning protection equipment shall meet the requirements specified herein.
- C. Lightning protection systems shall consist of, but not be limited to, air terminals; main, bonding, and down conductors; ground terminals; and all required connectors and fittings required to complete the system.
- D. The lightning protection system shall include the bonding of all roof-mounted mechanical equipment, roof drains, roof mounted ladders, chimneys, antennas, and other roof mounted metal objects.

1.2 GENERAL

- A. Contractor shall furnish all installation drawings, tools, equipment, materials, and supplies and shall perform all labor and obtain all inspections to complete the work as specified, and in compliance with all codes, standards, and regulations.
- B. Contractor shall provide coordination with other contractors and supervision of installation as needed during construction.
- C. The design of the system shall include determination of the overall lightning hazard for the geographic location of the project and for the structures, the selection of Class I and/or Class II materials, the need of corrosion protection for the copper and/or aluminum components used, and consideration of other pertinent factors. The design shall produce a zone of protection from lightning to prevent personal injury, structural damage, and equipment downtime.
- D. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of UL unless exceptions are noted by Engineer.
- E. The system shall be installed by an installer who has UL listing and subscribes to the UL Follow-Up Service.
- F. General Equipment Stipulations

Lightning Protection for Structures

1. The General Equipment Stipulations section shall apply to all equipment furnished under this section. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence.

G. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Contract Drawings.

H. Governing Standards

1. All system components furnished under this section shall be designed in accordance with ANSI/UL 96 - Lightning Protection Components. All lightning protection systems furnished under this section shall be designed, constructed, and tested in accordance with UL 96A – Installation Requirements for Lightning Protection Systems and ANSI/NFPA 780 – Standard for the Installation of Lightning Protection Systems.
2. Lightning protection systems shall be bonded to grounding electrode systems in accordance with the National Electrical Code.

I. Workmanship and Materials

1. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.
2. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, unless required by tests.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete certification of design calculations; assembly, and installation drawings; together with complete engineering data covering the materials used and the parts, devices, and accessories forming the system, shall be submitted in accordance with the Submittals Procedures section.

B. Meteorological and Seismic Design Criteria Compliance

1. Submit confirmation of compliance with the requirements as indicated on the Contract Drawings. =

Lightning Protection for Structures

1.4 QUALITY ASSURANCE

- A. The lightning protection system shall be inspected and tested after installation by conducting continuity and ground resistance tests as well as a visual inspection. Inspection results and test data shall be submitted in accordance with the Submittals Procedures section. Upon completion of the installation, Contractor shall apply for and deliver the UL Master Label Certificate of Inspection for each structure/building.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The system components shall be manufactured by a company that has been specializing in the design and manufacture of UL listed lightning protection equipment for at least 5 years.

2.2 MATERIALS

- A. All manufactured and fabricated components shall conform to NFPA 780 Class I or Class II as needed for the structures on which they will be installed. The system components shall be fabricated from the following metals:

| | |
|----------------------|----------------------|
| Conductors | Copper. |
| Air Terminals | Copper or bronze. |
| Grounding Electrodes | Copper clad steel. |
| Fasteners | Copper or bronze. |
| Bimetallic Fasteners | Bronze and aluminum. |

- B. Aluminum conductors and air terminals shall be mounted on aluminum surfaces only.
- C. All materials furnished for the lightning protection system shall bear the inspection label of UL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The lightning protection system shall be installed in a neat and inconspicuous manner so all components will blend in with the appearance of the building. All conductors shall be concealed or semi-concealed during construction using methods recommended in NFPA 780 and UL 96A.
- B. Air terminals shall have base supports designed for the surface on which they are used and shall be securely anchored. All exposed metal eave troughs, roof vents, guy wires, antennas, and air handling equipment shall be bonded to the lightning protection system in such a way that two paths to ground are provided.

Lightning Protection for Structures

- C. The lightning protection system shall be bonded to structure/building electrical ground rings wherever they are available.

End of Section

Open-Channel Metal Sluice Gates

Section 40 05 59 – OPEN-CHANNEL METAL SLUICE GATES

PART 1 - GENERAL

1.1 SCOPE

- A. This Section covers furnishing and installation of sluice gates and actuators as specified herein and as indicated in the drawings. A stainless steel sluice gate is defined herein as a heavy-duty gate with a four-sided seal system that is used to close off an orifice that experiences a maximum water level that can exceed the top of the orifice.
- B. Sluice gates shall be furnished by the UV System Supplier, complete with frames, sluices, seals, actuators, operating stems, and appurtenances as specified herein, as indicated in the schedule and as specified in the Valve and Gate Actuator section.

1.2 GENERAL

- A. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. Equipment installed under this Section shall be erected and placed in a proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- C. Gates and actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest products of a manufacturer engaged in the production of sluice gates.
- D. Any gates and actuators identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.
- E. Coordination:
 - 1. When installation check services are provided by the gate manufacturer, Contractor shall coordinate the services with the gate manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's installation check services.
 - 2. Submittals for equipment furnished by others under each procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for

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determining and verifying all quantities, dimensions, and field construction criteria.

F. General Equipment Stipulations.

1. The General Equipment Stipulations shall apply to all equipment furnished under this Section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

G. Governing Standard.

1. Except as modified or supplemented herein, all sluice gates shall conform to the applicable requirements of ANSI/AWWA C561.

H. Identification.

1. Sluice gates specified herein shall be tagged as specified in the Equipment and Valve Identification section.

1.3 QUALITY ASSURANCE

- A. The basis for the design of the sluice gates and slide gates is the Model RW1000-S as manufactured by RW Gate Company, Troy, NY.
- B. All gates shall be shop inspected for proper operation prior to shipment. Sluice gates, gates with seals on all four sides, shall be factory leakage tested in the unseating head direction with clean water at the design head. Certified test data shall be included in the O&M.
- C. Welds shall be performed by welders with ASME Section IX or AWS D1.6 certification.
- D. The gate manufacturer shall be ISO 9001:2015 certified.

1.4 SUBMITTALS

- A. Complete drawings, construction details, anchorages, and specifications covering the sluice gates and appurtenances shall be submitted in accordance with the Submittals Procedures section. Each drawing shall be identified with the sluice gate designation.
- B. Drawings shall include separate wiring diagrams for each electrically actuated gate and related electrical control equipment. Electric actuators with identical service may submit a single wiring diagram.

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PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. Sluice gates will be required on the upstream and downstream side of the UV equipment of each channel to provide isolation of the equipment.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Sluice gates shall be designed for the conditions and requirements indicated in the Sluice Gate Schedule. Leakage for sluice gates and slide gates shall be restricted to 0.05 gpm/ft or less of the seal perimeter at the design seating head and the design unseating head.
- B. Design.
1. Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fourth of the ultimate strength of each material.
 2. Gates shall be designed for the seating and unseating heads indicated in the Sluice Gate Schedule.
 3. Gates shall be designed to fit into the structures indicated on the Drawings.

C. Gate Schedule

| GATE NAME/ DESCRIPTION | MATERIAL | OPENING SIZE | MOUNTING TYPE | OPERATING HEAD | STEM CONFIGURATION | SEALING CLOSURE | OPENING DIRECTION | OPERATOR/ OPERATOR MOUNT |
|-----------------------------|--------------------|--------------------|------------------|-------------------|-----------------------|--------------------|----------------------|--------------------------------|
| East Channel Inlet Gate | Stainless Steel | 72 by 72 inches | Sidewall | 12 feet | Rising | Four-Sided | Upward | Electric/ Wall Bracket |
| West Channel Inlet Gate | Stainless Steel | 72 by 72 inches | Sidewall | 12 feet | Rising | Four-Sided | Upward | Electric/ Wall Bracket |
| East Channel Outlet Gate | Stainless Steel | 72 by 72 inches | Sidewall | 12 feet | Rising | Four-Sided | Upward | Electric/ Floor Stand |
| West Channel Outlet Gate | Stainless Steel | 72 by 72 inches | Sidewall | 12 feet | Rising | Four-Sided | Upward | Electric/ Floor Stand |

2.3 ACCEPTABLE MANUFACTURERS

- A. For sluice gates, acceptable manufacturers are RW Gate as supplied by the UVSS.

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2.4 MATERIALS OF CONSTRUCTION

- A. All stainless steel referenced in this specification shall be Type 304 (316), ASTM A240, or ASTM A276 unless otherwise indicated herein.
 - 1. All welded stainless steel components shall be constructed of Type 304L (316L) stainless steel.
 - 2. All structural stainless steel used in the construction of slides and frames shall have a minimum material thickness of 1/4 inch.
 - 3. All non-welded stainless steel components, excluding anchor bolts and assembly bolts, shall be Type 304 (316) or Type 304L (316L) stainless steel.
 - 4. Anchor bolts and assembly bolts shall be Type 316 stainless steel.

2.5 CONSTRUCTION

A. SLIDE

- 1. The slide shall consist of a stainless steel plate that is reinforced with stiffeners to withstand the specified head conditions. The slide shall engage the frame a minimum of 1 inch on each side.
 - a. The slide shall be reinforced with plates or channel-shaped members to restrict deflection to 1/16 inch or less at the design head.
 - b. The stiffeners shall be welded to the slide plate in the horizontal and vertical positions.
 - c. The portion of the slide that engages the frame shall have a minimum thickness of 1/2 inch.
 - d. On rising stem gates, a stem connector shall be welded to the slide as a means of connecting the operating stem. The bottom portion of the stem shall be affixed to the stem connector with a minimum of two attachment bolts.
 - e. On non-rising stem gates, the slide shall be arranged to allow travel of the stem along the length of the slide.

B. FRAME

- 1. The frame shall be constructed of stainless steel plate, with the guide section formed into a C channel shape or similar to house the seal, and shall be reinforced to withstand the specified operating conditions.
 - a. The guides shall be of a one-piece design with gussets that extend along the outside and top to accommodate unseating head. The guide members shall incorporate a tubular cross section along the guides for additional rigidity. Two-piece, sandwich type guides that are bolted together are not acceptable.
- 2. The mounting configuration of the frame shall be as shown on the Contract Drawings.

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3. Wall-mounted frames shall be of the flanged frame type. Flat frames shall only be provided on gates with frames that will be embedded in the concrete wall or mounted inside existing channels.
4. The guide portion of flanged frame gates shall have a minimum weight of 13 lbs/ft. The portion of the flanged frame, where the anchors penetrate, shall have a minimum thickness of 1/2 inch.
5. The guide extension portion of the frame shall have a minimum weight of 6 lbs/ft. Angles are not considered acceptable guide extensions.
6. Lifting lugs shall be provided on all frame styles.
7. On self-contained gates, the side frame shall extend above the operating floor and the operating mechanism shall be mounted to the yoke. When shown, the frame may extend to or below the operating floor and a floor stand may be mounted on the yoke.
8. Yoke members shall be C channel shaped structural members. Angles are not considered acceptable yoke members.

C. SEALS

1. The seal system shall consist of self-adjusting UHMWPE seals with a nitrile or EPDM compression cord.
 - a. The UHMWPE seals shall be arranged to ensure that there is no metal-to-metal contact between the slide and frame.
 - b. The compression cord shall be contained by the UHMWPE seal so that it shall not be in contact with the slide.
 - c. Seal system shall be self-adjusting for the life of the gate. Adjustable wedging devices such as wedges, wedge bars, and pressure pads are not acceptable.
 - d. On upward-opening gates, rubber side seals and/or top seals such as J-bulb seals or similar rubber seals are not acceptable in lieu of UHMWPE seals.
 - e. On downward opening gates, rubber side seals and/or invert seals such as J-bulb seals or similar rubber seals are not acceptable in lieu of UHMWPE seals.
 - f. The invert seal on upward opening gates shall use a compressible EPDM seal located in the invert of the frame.
 - 1) The invert seal shall be of a flush bottom arrangement.
 - 2) The invert seal shall be mechanically fastened with stainless steel bolts.
 - 3) Invert seals attached solely by the use of adhesives are not acceptable.
2. All seats and seals shall be secured with assembly bolts. All seals shall be field removable and field replaceable without the need to remove the gate frame from the wall. Gates that require disassembly of any portion of the frame to replace seals are unacceptable.

Open-Channel Metal Sluice Gates

3. Anchor bolts shall not penetrate the seats or seals, and anchor bolts shall not prevent the removal or replacement of seats or seals.
4. The seal system shall have been shop tested with a minimum 30,000 cycle operating test in an abrasive environment to confirm the ability of the seals to withstand the abrasive condition with negligible deterioration and to confirm that the leakage restriction requirement is still possible.
5. The shop test shall have been performed on a stainless steel sluice gate and the test results shall have been certified by the manufacturer in writing.
 - a. A copy of the test shall be provided to the Engineer.

D. OPERATING STEM

1. The operating stem shall be of stainless steel and shall be designed to transmit in compression at least 2 times the rated output of the manual operating mechanism with an 80 lbs effort.
2. The stem shall have a slenderness ratio (L/r) less than 200.
3. The threaded portion of the stem shall have a minimum diameter of 1-1/2 inches.
 - a. The threads shall have machine rolled, full depth ACME threads.
 - b. Stub threads are not acceptable.
4. Stems provided in multiple pieces shall be provided with couplings.
 - a. Couplings shall be bronze or stainless steel and shall be internally threaded and keyed or bored and bolted.
5. Stem guides shall be constructed of stainless steel with UHMWPE bushings.
6. Gates with rising stems shall be provided with a clear plastic stem cover.
 - a. The stem cover shall be butyrate and shall have a cap and condensation vents.
 - b. Clear mylar indicating tape shall be provided for field application after the gate has been installed and positioned.
7. Stop collars shall be provided to limit the downward travel on gates with manual operating mechanisms.
 - a. Stop collars shall be bronze and shall be internally threaded and provided with a stainless steel set screw.

E. OPERATING MECHANISM

1. Operating mechanisms shall be provided by the gate manufacturer.

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2. Manual operators shall be yoke mounted on self-contained gates or floor stand mounted when shown in the Contract Documents.
 - a. Manual operators shall be of the bevel gear type suitable for operation with a portable operator.
 - b. Gear ratios shall be selected by the gate manufacturer to ensure that the maximum operating effort is 40 lbs at the design head.
 - c. Minimum gear ratio shall be 2:1.
 - d. Gearboxes shall have ductile iron housings, a bronze lift nut, steel gears, and a stainless steel input shaft.
 - e. Ball or roller bearings shall support the lift nut and input shaft.
 - f. The housing shall be grease lubricated and permanently sealed.
 - g. Handwheels shall be provided. Handwheels shall have a maximum diameter of 24 inches.
 - h. Adaptor plates shall be utilized to attach the operating mechanism to the yoke. Adaptor plates shall be stainless steel and shall have a minimum thickness of 3/4 inch.

3. Electric motor actuators shall be provided as part of the UVSS scope of supply. Actuators shall be Rotork IQ25 electric actuators and provided by RW Gate Company.

| | |
|---------------------|--------------------|
| a. Actuator | IQ3 25 F14 A WT |
| b. Actuator Speed | 43 rpm |
| c. Torque | 219.79 lbs ft |
| d. Thrust | 22,480.89 lbsf |
| e. Resultant Thrust | 9,043.22 lbsf |
| f. Operating Time | 217.67 secs |
| g. Electrical Data | 480V/3 phase/60 Hz |

4. Interconnected gearboxes and multiple stems shall be provided to ensure proper operation of wide gates.
 - a. Interconnected gearboxes are required on all upward opening gates when the opening width is greater than 60 inches and the height of the slide is less than half of the width.
 - b. Interconnected gearboxes are required on all downward opening gates when the opening width is greater than 48 inches and the height of the slide is less than half of the width.
 - c. Interconnected gearboxes shall consist of a stainless steel interconnecting shaft with flexible couplings on each end and stainless steel hardware. Aluminum shafts are not acceptable.
 - d. Gates with interconnected gearboxes, driven by an electric motor operator, shall be provided with a shroud to cover the interconnecting shaft.
 - 1) The shroud shall be removable.
 - 2) The shroud shall be constructed of stainless steel and shall have a minimum thickness of 20 gauge.

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F. FLOOR STANDS AND WALL BRACKETS

1. Floor stands shall be mounted to the concrete, mounted to a wall bracket, or mounted on the yoke of a self-contained gate as shown on the Contract Drawings.
2. All floor stands and wall brackets shall be fabricated from stainless steel.
 - a. The base plate, adaptor plate, and gussets shall be minimum 1/2-inch thick.

G. ANCHORAGE

1. Anchor bolts shall be 316 stainless steel, fully threaded and shall have a minimum diameter of 1/2 inch.
2. Anchor bolts shall be of the epoxy type.

H. FINISH

1. All heat tint and slag from the welding process shall be passivated in accordance with ASTM A380. If bead blasting is used, the entire slide and entire frame shall be bead blasted.
2. All ferrous components shall be suitably prepared and then shop coated with primer. Finish coating shall be applied by the Contractor. The ductile iron operator housing shall be finish coated by the Contractor with a suitable paint that complies with the Painting section.

2.6 SHOP PAINTING

- A. All surfaces of aluminum which will be in contact with concrete, mortar, grout, or dissimilar metals shall be given a coat of epoxy enamel or coal tar epoxy. The epoxy coating shall be NSF certified for gates installed in a potable water facility.

PART 3 - EXECUTION

3.1 INSPECTION

- A. All gates and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

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3.2 INSTALLATION

A. General

1. Gates and appurtenances shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the gate for maintenance. Installation shall be in accordance with the manufacturer's recommendations and the requirements specified herein.
2. All bolts shall be tightened and all items requiring lubrication, including pivot pins, shall be lubricated. Anti-seize thread lubricant shall be liberally applied to the threaded portion of stainless steel anchor bolts during the installation and tightening of nuts. Excess lubricant shall be thoroughly removed following final tightening.
3. Non-shrink grout shall be applied by the Contractor between the gate frame and the wall to ensure that there is no leakage around the gate.
4. The threaded portion of each plastic stem cover shall be wrapped in at least two layers of Teflon thread tape, and the threaded portion of steel pipe stem covers shall be coated with Teflon thread sealer immediately prior to installation of the cover on the actuator.
5. Each gate shall be adjusted so that it does not bind or leak in excess of specified requirements. After installation, each gate shall be operated through at least two complete open-close cycles, readjusted and re-operated as necessary, and left in a condition acceptable to Engineer.

B. Installation Check.

1. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative will inspect the gate installation immediately following installation by Contractor, shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.
2. Contractor shall perform no Work related to the installation or operation of materials or equipment furnished by others without direct observation and guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.
3. The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.
4. All costs for these services shall be included in the contract price.
5. Manufacturer shall include a minimum of 2 day(s) and 1 trip(s) to the site.

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C. Open-Channel Metal Sluice Gates and Weir Gates.

1. Each open-channel sluice gate or weir gate shall be carefully installed and adjusted for proper operation. Care shall be taken to avoid deformation of the gate frames and to maintain tolerances between seating faces.
2. Each embedded frame shall be carefully braced in the forms before concrete is placed, or a space shall be boxed out and the frame shall be grouted in place later. Care shall be exercised to ensure that frame members and anchor bolts do not rest upon or contact steel reinforcing bars.
3. Components of aluminum open-channel sluice gates or weir gates installed in contact with concrete shall be coated with epoxy in accordance with the Protective Coatings section prior to installation. Damaged areas of shop-applied coatings shall be recoated and allowed to cure before placement of concrete or grout. Anchor bolts shall be carefully set using a template.

3.3 GATE ACTUATORS

- A. Gate actuators and accessories shall be installed in accordance with the equipment manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. Field Testing.

1. After installation, all gates shall be pressure tested for leakage at the hydrostatic heads specified. Leakage exceeding the specified limits that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.
2. Upon successful field testing, equipment supplier shall submit a written report of testing, results, modifications, and certification that the gates were installed correctly and fully adhere to the contract documents.

B. Fabricated Stainless Steel Sluice Gates.

1. For the maximum seating and unseating heads, the leakage shall not exceed 0.05 gpm per foot of seating perimeter.

3.5 ADJUSTING

- A. After installation, the opening and closing time shall be adjusted as needed for each pneumatic, hydraulic, or electric actuated gate.

End of Section

SECTION 40 61 11 - INSTRUMENTATION AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the modification of an existing instrumentation and control system designated as the Plant Instrumentation and Control System (PICS). PICS modifications include removal of the existing UV System hardware, graphics screens, and data points, and adding new hardware, graphics screens, and data points for the new UV System.
- B. The system shall be modified as specified, complete with all software, human machine interface (HMI) hardware, input/output hardware, instrumentation, and all devices, accessories, appurtenances, testing, and training necessary for proper operation.
- C. The System Supplier's scope includes the aforementioned PICS modifications as well as adding a signal splitter to the existing CP-70 PLC panel to split the existing plant effluent flow signal to both the existing CP-70 PLC and the new UV PLC.
- D. Associated Sections
 - 1. This section also includes the equipment and services specified in the following sections.
 - Section 40 66 33 METALLIC AND FIBER OPTIC COMMUNICATION CABLE AND CONNECTORS
 - Section 40 68 83 SOFTWARE CONTROL BLOCK DESCRIPTIONS
 - Section 40 78 00 PANEL MOUNTED INSTRUMENTS

1.2 GENERAL

- A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. General Equipment Stipulations
 - 1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.
- C. Drawings

Instrumentation and Control System

1. The Drawings indicate locations and arrangements of equipment and may include installation details and block and one-line diagrams showing connections and interfaces with other equipment.
2. Principal components of the instrumentation systems shall be as indicated on the P&ID drawings and instrument device schedule attached to this section.

D. Codes, Permits and Agency Approvals

1. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters' Laboratories. Contractor shall, as part of their work, arrange for and obtain all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

E. Supplier's Qualifications

1. Equipment and software furnished under this section and under other related sections listed in the Scope paragraph above shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Supplier. The System Supplier shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Contractor shall utilize the services of the System Supplier to coordinate all control system related items, to check-out and calibrate instruments, and to perform all testing, training, and startup activities specified to be provided.
2. The System Supplier be CCI or Perceptive Controls, without exception.

F. Coordination

1. Systems supplied under this section shall be designed and coordinated by System Supplier for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment. All equipment shall be designed and installed in full conformity with the Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, and the manufacturer of the related equipment.

G. Related Equipment and Materials

1. Related equipment and materials may include, but will not be limited to, instrumentation, motor controllers, valve actuators, chemical feeders, analytical measuring devices, conduit, cable, and piping as described in other sections or furnished under other contracts.

H. Device Tag Numbering System

1. All devices shall be provided with permanent identification tags. The tag numbers shall agree with System Supplier's equipment drawings and shall be as close as practical to the tag numbers used on the Drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and

Instrumentation and Control System

rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

1.3 GENERAL REQUIREMENTS

- A. The Drawings and Specifications indicate the extent and general arrangement of the systems. If any departures from the Drawings or Specifications are deemed necessary by System Supplier, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.
- B. The specifications describe the minimum requirements for hardware and software. Where System Supplier's standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.
- C. Governing Standards
 - 1. Equipment furnished under this section shall be designed, constructed, and tested in accordance with IEEE 519, ANSI C37.90, FCC Part 15 - Class A, and NEMA ICS-1-109.60.
- D. Dimensional Restrictions
 - 1. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values. The System Supplier shall review the Drawings, the manufacturer's layout drawings and installation requirements, and make any modifications requisite for proper installation subject to acceptance by Engineer. At least three feet of clear access space shall be provided in front of all instrumentation and control system components.
- E. Workmanship and Materials
 - 1. System Supplier shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.
 - 2. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except for testing.
- F. Corrosive Fluids
 - 1. All parts which are exposed to corrosive conditions shall be made from corrosion resistant materials. System Supplier shall submit certification that the instrument manufacturer approves the selection of materials of primary elements that are in contact with the specified process fluid to be inert to the effects of the process fluid.
- G. Appurtenances

Instrumentation and Control System

1. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. All equipment furnished under each section referenced in SCOPE is a part of this section and shall be selected by System Supplier for its superior quality and intended performance. Equipment and materials used shall be subject to review.
- B. Standard Products
 1. The systems furnished shall be standard products. Where two or more units of the same type of equipment are supplied, they shall be the products of the same manufacturer; however, all components of the systems furnished hereunder need not be the products of one manufacturer unless specified herein.
 2. To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The design of the systems furnished hereunder shall utilize concepts, techniques and features that provide maximum reliability and ease of maintenance and repair. The systems shall include board-level devices such as light emitting diodes or other indicators to facilitate quick diagnosis and repair. Diagnostic software shall be furnished to facilitate system-level troubleshooting.
- B. Where redundant hardware is provided, the system shall be capable of performing all specified functions, without reconfiguring hardware or software, with only one device of each category in service.
- C. Factory Assembly

Equipment shall be shipped completely factory assembled, except where its physical size, arrangement, configuration, or shipping and handling limitations make the shipment of completely assembled units impracticable.

2.3 POWER SUPPLY AND INSTRUMENT SIGNAL

- A. Power supply to all control system equipment will be 120 volts ac. System Supplier shall be responsible for distribution of power among enclosures, consoles, peripherals, and other components of the system from the power supply receptacles and junction boxes indicated on

Instrumentation and Control System

the Drawings. Power distribution hardware shall include cables and branch circuit overcurrent protection installed in accordance with the electrical section.

- B. Unless otherwise indicated, power supply to the instrumentation will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.
- C. Facility Distribution System
 - 1. Equipment not indicated to be powered from an uninterruptible power source shall be suitable for being supplied from the facility distribution system and shall be capable of withstanding voltage variations of ± 10 percent and harmonics up to the limits of IEEE 519 without affecting operation. System Supplier shall provide voltage conditioning or filtering equipment if necessary to meet the requirements specified.
- D. Power Supplies
 - 1. Power supplies for voltages other than those listed above shall be an integral part of the equipment furnished. Internal power supplies shall be regulated, current limiting, and self-protected.
- E. Surge Withstand
 - 1. All equipment shall meet all surge withstand capability tests as defined in ANSI C37.90 without damage to the equipment.

2.4 SERVICE CONDITIONS AND ENVIRONMENTAL REQUIREMENTS

- A. The equipment provided for the instrumentation and control system shall be suitable for the service conditions specified in the attached equipment sections.
- B. All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.
- C. Ambient Temperature and Elevation
 - 1. All system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10° C to 35° C and a relative humidity of 10 to 80 percent, noncondensing. All equipment located in non-air conditioned indoor areas shall be suitable for an ambient temperature range of 0° C to 50° C and a relative humidity of 10 to 95 percent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20° C to 60° C and a relative humidity of 5 to 100 percent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.
 - 2. All equipment and instruments shall be designed to operate at the site elevation of 727 ft.
- D. Noise Level

Instrumentation and Control System

1. The equivalent "A" weighted sound level for any system equipment located in the control room, except printers, shall not exceed 35 dBA. The sound level for printers shall not exceed 65 dBA. Sound reduction enclosures shall be provided where necessary to comply with these limits.

E. Lightning Protection

1. In addition to other environmental protection specified herein, the entire system shall be provided with lightning protection. Lightning protection measures shall include the following.
2. Grounding
 - a. All major components of the system shall have a low resistance ground connection. Grounding system provisions indicated on the Drawings shall be modified as recommended by System Supplier.
3. Surge Suppressors
 - a. Surge and lightning suppressors shall be non-faulting, non-interrupting, and shall protect against line-to-line and line-to-ground surges. Devices shall be solid-state metal oxide varistor (MOV) type, silicon junction type, Gas Discharge Tube (GDT) type, or some combination of these types, with a response time of less than 50 nanoseconds. Surge protective devices shall be applied for the following:
 - 1) All 120 volts ac power connections to PLCs, instruments and control room equipment. Surge arresters shall be Transtector "SPD 12R Series", Phoenix Contact "PLT-SEC Series", MCG Surge Protection "400 Series" or equal.
 - 2) All analog signal circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Surge protection devices shall not impede or interfere with the use of smart transmitter calibration/communication.
 - a) Protection devices located at the field transmitter shall be:
 - Loop Powered Transmitters – Eaton MTL "TP48", Phoenix Contact "Surge Trab Series", Transtector "PDS Outdoor Series" or equal.
 - Four-Wire Transmitters – Phoenix Contact "BoxTrab Series", Schneider Electric ASCO Model 265, Emerson "SolarHD STC-SLAC Series", or equal.
 - b) Protection devices in control panels shall be Transtector "12R IEP Series", Eaton MTL "SD Modular Series", Phoenix Contact "TTC-6P Series", or equal.
 - 3) All metallic pair (twisted and untwisted) conductor local area network termination points, where any part of the cable is routed outside of the building envelope. Single-port protective devices shall be Phoenix Contact "DataTrab Series", Transtector "FSP" Series", Citel "MJ8 Series", Eaton MTL "NP Series", or equal.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. The installation of equipment furnished hereunder shall be by the Contractor or their assigned subcontractors.
- B. Field Wiring
 - 1. Field wiring materials and installation shall be in accordance with the electrical section.
- C. Instrument Installation
 - 1. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily operated. Installation details for some instruments are indicated on the Drawings.
 - 2. All outdoor instrumentation shall be protected from direct sun exposure. Instruments shall be placed in locations to limit south and west sun exposure. Sunshades shall be provided on instruments that are subject to the direct sun exposure. Sunshades shall be located so the opening faces north or east where possible. Sunshades shall be provided as shown on the Drawings.
- D. Salvage of Existing Equipment
 - 1. Existing equipment and materials removed or replaced under this contract shall be delivered to Owner at a location designated by Owner, or shall be properly disposed of at Owner's discretion. Care shall be taken to avoid damage to equipment delivered to Owner.
 - 2. Any mounting brackets, enclosures, stilling wells, piping, conduits, wiring, or openings that remain after removal of equipment and support hardware shall be removed or repaired in a manner acceptable to Owner and Engineer. Transmitters or switches containing mercury shall be removed and disposed of by personnel trained in the handling of hazardous materials and using approved procedures.

3.2 SYSTEM SOFTWARE CONFIGURATION

- A. Existing system software, Rockwell Automation Factory Talk SE V 12 and Factory Talk Historian SE V 7, shall be configured by the System Supplier. Configuration services shall consist of the modification of the existing system database, report formats, operator interface graphic and tabular display screen formats, and programming of control units to provide a fully functioning system. The System Supplier shall fully configure the system using data provided herein or supplied by the Engineer and/or the Owner after award of the contract.
- B. Tuning of software programs shall be accomplished in such a manner that the program operates at its highest performance level. These programs include, but are not limited to Microsoft SQL Server, all PLC ladder logic, and others.

C. Control System Database

1. The control system database shall be modified and configured by the System Supplier. The System Supplier shall enter information obtainable from the Contract Documents into the database prior to soliciting input from the Engineer and the Owner. The System Supplier shall coordinate with the Ultraviolet System Supplier (UVSS) to incorporate data points available from the UV PLC into the database. The System Supplier shall determine the need for any "pseudo" database points and shall ascertain and enter all information needed to define these points. The System Supplier is responsible for entering all information associated with each point. This includes but is not limited to, descriptions, engineering units, associated displays, areas, security, etc. All fields associated with each database point must be completely filled out accurately.

D. Graphic Screen Displays

1. The System Supplier shall be responsible for developing and configuring the custom graphic displays associated with the new UV System for display on the Plant HMI. Each piece of major process equipment that is monitored by the UV System shall be displayed on one or more graphic screen. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that are part of the control loops. These items must be done in accordance to the City of Ann Arbor's existing graphics standards. Alarm and/or event displays shall also be provided and proven functional prior to acceptance of the system. A means of capturing and printing of all graphic screens shall also be included. The software program provided must be capable of printing the screen in a black and white (using gray scale) or color format. This program must be accessible from all terminals provided under this contract. The black and white printing shall be done in a manner in which the use of the black background is not represented in the printout. This is done to keep the utilization of ink cartridge and toner cartridge to a minimum.
2. All graphic screens shall be animated to indicate the current state of the piece of equipment. The following graphic screens shall be provided or modified if existing, as a minimum.
 - a. Main Overview of Plant – modification as necessary to include new UV System
 - b. UV System – new screen(s) to match new UV System Supplier's screen(s)
 - c. Alarm Summary – modification to include new UV System alarms
 - d. Event Summary – modification to include new UV System events
 - e. Overview of each major process area (with vectoring to sub-areas) – modification to include new UV System

E. Report Formats

1. Report formats shall be developed and programmed by the System Supplier using tag names defined in the database modification. Reports shall be provided as summarized below. All reports will be provided with a header on each page to indicate the contents of each column of information. Each page shall be numbered and indicate the name of the report, the date the report was printed, and the time of the printout. The printout shall also include the time span of the information shown on the report.

Instrumentation and Control System

- a. Daily Operating Report. A daily report, listing the UV System variables (up to 24 variables) shall be provided. The report shall include hourly values and minimum/maximum/average values where appropriate. A minimum of 1 daily report shall be provided by the System Supplier.
- b. Monthly Operating Report. A monthly operating report, which averages the values from the above daily reports, shall be provided. The report shall include monthly minimum/maximum/average values where appropriate.

F. Configuration Review Meetings

1. Proposed graphic screens and report formats shall be reviewed with the Owner throughout the configuration process. The System Supplier's programming personnel shall attend all meetings. A second review meeting shall be held at approximately 50 percent completion. Both meetings shall be held at the Owner's facilities.

G. Software Functional Requirements

1. General functional requirements for system configuration are indicated on the Drawings and described in the specifications. The information presented herein and indicated on the Drawings illustrates the general functional intent of the system, and may not be sufficient to fully configure the system. The System Supplier shall be responsible for determining what additional information may be required to complete the configuration tasks, and for obtaining this information from the Engineer or the Owner.

3.3 TESTING

A. Site Acceptance Testing

1. After installation and checkout by UV System Supplier's (UVSS) personnel, the system shall be subjected to an acceptance test. Refer to the Open Channel Ultraviolet Disinfection System section for testing and coordination requirements.

End of Section

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13500A - INSTRUMENT DEVICE SCHEDULE

Instrument Device Schedule - Legend/Description Sheet

System. Contains the system code assigned to each instrument/device. System code abbreviations are found on legend sheet I-002

Type. This is the ISA (or similar) alpha tag representing the function of the instrument.

Loop Number. This is the numeric (or alphanumeric) loop designation for the instrument.

Service Description. This is the description of the instrument service (i.e. Filter No. 1 Loss-of-Head).

Device Type and Size. This is the instrument device type and should match the description as listed in the specification. A size is given if applicable (e.g., flow meters)

Size. Element size for flow applications or size as required by specialized instruments

Output Type. This generally will be '4-20 mA' or 'Dry Contact'. It could also be a serial output for smart devices (such as HART or FIELD-BUS) but only if the serial output is the primary I/O interface.

Output Range. This is the calibrated range for analog devices or the trip point(s) for discrete devices.

Power Type. This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered from external power supplies, unless noted otherwise.

Drawing Name. This is the drawing number of the P&ID where the device is shown.

Specification. The provider for the specification section listed is responsible for supplying the device.

Remarks. This column may include a cross reference to another specification section where applicable or to a note which provides additional information. Notes are appended to the end of the device

| Item | System | Type | Loop Number | Tag | Service Description | Device Type | Size | Output_Type | Output_Range | Power_Type | DWG Number | Specification |
|------|--------|------|-------------|-------------|---|--|------|-------------|--------------|------------|------------|---------------|
| 1 | UV | AIT | 001 | UV-AIT-001 | UV INFLUENT UV TRANSMITTANCE | UVT TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 2 | UV | AE | 001 | UV-AE-001 | UV INFLUENT UV TRANSMITTANCE | UVT SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 3 | UV | AE | 111 | UV-AE-111 | UV CHANNEL 1 BANK 1 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 4 | UV | AE | 121 | UV-AE-121 | UV CHANNEL 1 BANK 2 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 5 | UV | AE | 131 | UV-AE-131 | UV CHANNEL 1 BANK 3 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 6 | UV | AE | 141 | UV-AE-141 | UV CHANNEL 1 BANK 4 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 7 | UV | ZS | 111 | UV-ZS-111 | UV CHANNEL 1 BANK 1 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 8 | UV | ZS | 121 | UV-ZS-121 | UV CHANNEL 1 BANK 2 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 9 | UV | ZS | 131 | UV-ZS-131 | UV CHANNEL 1 BANK 3 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 10 | UV | ZS | 141 | UV-ZS-141 | UV CHANNEL 1 BANK 4 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 11 | UV | AE | 211 | UV-AE-211 | UV CHANNEL 2 BANK 1 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 12 | UV | AE | 221 | UV-AE-221 | UV CHANNEL 2 BANK 2 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 13 | UV | AE | 231 | UV-AE-231 | UV CHANNEL 2 BANK 3 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 14 | UV | AE | 241 | UV-AE-241 | UV CHANNEL 2 BANK 4 UVI | UVI SENSOR | N/A | N/A | N/A | N/A | I-101 | 46 66 56 |
| 15 | UV | ZS | 211 | UV-ZS-211 | UV CHANNEL 2 BANK 1 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 16 | UV | ZS | 221 | UV-ZS-221 | UV CHANNEL 2 BANK 2 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 17 | UV | ZS | 231 | UV-ZS-231 | UV CHANNEL 2 BANK 3 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 18 | UV | ZS | 241 | UV-ZS-241 | UV CHANNEL 2 BANK 4 POSITION | POSITION SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 19 | UV | LSLL | 101 | UV-LSLL-101 | UV CHANNEL 1 LEVEL LOW-LOW | ELECTRODE/CONDUCTANCE RELAY LEVEL SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 20 | UV | LSLL | 201 | UV-LSLL-201 | UV CHANNEL 2 LEVEL LOW-LOW | ELECTRODE/CONDUCTANCE RELAY LEVEL SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 21 | UV | AIT | 111 | UV-AIT-111 | UV CHANNEL 1 BANK 1 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 22 | UV | AIT | 121 | UV-AIT-121 | UV CHANNEL 1 BANK 2 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 23 | UV | AIT | 131 | UV-AIT-131 | UV CHANNEL 1 BANK 3 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 24 | UV | AIT | 141 | UV-AIT-141 | UV CHANNEL 1 BANK 4 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 25 | UV | HS | 111 | UV-HS-111 | UV CHANNEL 1 PDC-1A-1C LOCAL-OFF-REMOTE | 3-POSITION SELECTOR SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 26 | UV | HS | 141 | UV-HS-141 | UV CHANNEL 1 PDC-1D LOCAL-OFF-REMOTE | 3-POSITION SELECTOR SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 27 | UV | AIT | 211 | UV-AIT-211 | UV CHANNEL 2 BANK 1 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 28 | UV | AIT | 221 | UV-AIT-221 | UV CHANNEL 2 BANK 2 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 29 | UV | AIT | 231 | UV-AIT-231 | UV CHANNEL 2 BANK 3 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 30 | UV | AIT | 241 | UV-AIT-241 | UV CHANNEL 2 BANK 4 UVI | UVI TRANSMITTER | N/A | 4-20mA | BY UVSS | 4-WIRE | I-101 | 46 66 56 |
| 31 | UV | HS | 211 | UV-HS-211 | UV CHANNEL 2 PDC-2A-2C LOCAL-OFF-REMOTE | 3-POSITION SELECTOR SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 32 | UV | HS | 241 | UV-HS-241 | UV CHANNEL 2 PDC-2D LOCAL-OFF-REMOTE | 3-POSITION SELECTOR SWITCH | N/A | DRY CONTACT | N/A | N/A | I-101 | 46 66 56 |
| 33 | UV | FY | 600 | UV-FY-600 | UV PLANT EFFLUENT FLOW | ELECTRONIC SIGNAL SPLITTER | N/A | 4-20mA | 0-100 MGD | 4-WIRE | I-101 | 40 78 00 |

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SECTION 40 66 33 - METALLIC AND FIBER OPTIC COMMUNICATION CABLE AND CONNECTORS

PART 1 - GENERAL

1.1 SCOPE

- A. The Metallic and Fiber Optic Communications Cable and Connectors section covers the furnishing and installation of cable systems to provide communications for the Instrumentation and Control System as indicated on the Drawings.
- B. Accessories and appurtenances shall be provided as specified herein to provide a complete and properly operating system.
- C. Equipment and services provided under this section shall be subject to the General Computer Control System Requirements specified in the Instrumentation and Control System Section. Supplementing the Metallic and Fiber Optic Communications Cable and Connectors section, network data, special requirements, and options are indicated on the Drawings.

1.2 SUBMITTALS

- A. See Section Instrumentation and Control System section.
 - 1. Submittals shall be as specified in the Instrumentation and Control System section.
- B. Qualifications
 - 1. The name, address and telephone number of the proposed contractor or subcontractor, including specific personnel to perform the work shall be included with the submittals. Provide the experience record of the subcontractor and personnel in performing work similar to that specified. Include the agency, contact person, and telephone number of at least three (3) previous network installation projects completed by the proposed subcontractor. The Engineer shall review and approve the network installation subcontractor and personnel prior to any of the related work being performed. This review will be conducted during the project submittal phase, as described below.
- C. Drawings and Data
 - 1. All material and equipment documentation shall be submitted for review in accordance with the Submittals section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment.
 - 2. Product data shall include the following in the Submittals section:
 - a. Sample of the proposed cable.

Metallic and Fiber Optic Communication Cable and Connectors

- b. Provide off-line maintenance aids and on-line diagnostics to check the performance of the communication links and interfaces of devices on the data highway.
- c. Provide a Recommended Spare Parts List (RSPL).

D. Operations and Maintenance Manuals

1. Operation and Maintenance Manuals shall have the following items included in addition to those items specified in other sections:
 - a. Description of all components.
 - b. Methods of connection.
 - c. Connection diagram.

1.3 SHIPMENT, PROTECTION, AND STORAGE

- A. Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of the Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All network cable, network hardware and accessories shall be designed, assembled and connected in accordance with the requirements of these Specifications and the Drawings.

2.2 ETHERNET UNSHIELDED TWISTED PAIR (UTP) CABLE

- A. Ethernet cables and connectors shall be provided for a complete and working system, and/or as shown on the Drawings. Cable for Ethernet wiring shall be Cat-6 cable. Cable shall be Cat-6. Jacket color coding for cables shall be as follows:

1. Standard Cat-6 - Yellow
2. Crossover cables - Red

- B. Category 6 UTP Cable

1. Cat-6 cable shall meet the following requirements:
 - a. 23 or 24 AWG
 - b. 4 pair solid strand FEP Teflon insulation
 - c. 100 Ohm impedance
 - d. 1-250 MHz frequency range
 - e. Min attenuation 19.9 Db
 - f. 100 Ohm impedance
 - g. Min NEXT 44.3dB/100MHz

Metallic and Fiber Optic Communication Cable and Connectors

- h. Min PS-NEXT 42.3dB/100MHz
 - i. Min ELFEXT 27.8dB/100MHz
 - j. Min PS-ELFEXT 24.8dB/100MHz
 - k. Min return loss 20.1 dB/100 MHz
 - l. Max delay skew 45 ns
 - m. Max propagation delay 540 ns
2. Plenum rated cable shall have FEP insulation jacketing and FEP insulation for conductors. Non plenum rated cable shall have PVC insulation jacketing and polyethylene insulation for conductors. Cat-6 cable shall be Belden 1872 or equal.

C. Ethernet Patch Cables

1. Pre-wired and terminated patch cables with RJ-45 connectors and lever protecting boot shall be furnished for all connections to computers, network equipment, and controller equipment except where physical conditions (i.e. length over 12 ft. or conduit size) require unterminated wire to be installed. Patch cables shall be Cat-6 and shall meet the requirements of Cat-6 cable specified in this section. Straight through cables shall be wired using the T568-B standard for both connectors as shown in section 3 (Ethernet Cable Installation). Crossover cables shall be wired using the T568-A standard for one connector and the T568-B standard for the opposite end.

2.3 ETHERNET CABLE TEST EQUIPMENT

- A. One hand-held network cable tester that is compatible with the provided network cabling shall be provided. The cable tester shall check for open pairs, shorted pairs, crossed pairs, reversed pairs and split pairs for faults up to 100 m. Tester shall be Black Box "Model SOHO Plus Tester", Fluke MicroScanner2 Pro, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The System Supplier shall be responsible for the coordination of the installation of all cable furnished hereunder. The System Supplier shall be responsible for the termination of all cable furnished hereunder.
- B. Cable Damage
1. If the cable becomes damaged during installation, the Contractor shall replace the entire reel of cable. Installation of new cable to replace damaged cable shall not be a basis of extra payment or contract completion time. In addition to installation of the new cable, the Contractor shall reimburse the Owner for the entire cost of the replacement reel of cable. This cost will be withheld from the contract price.
- C. Ethernet Cable Installation

Metallic and Fiber Optic Communication Cable and Connectors

1. Straight through cables shall be wired using the latest version of T568 standard for both connectors as shown in the table below (connector pin numbers are left to right with the clip down). Crossover cables shall be wired using the T568A standard for one connector and the T568B standard for the opposite end as shown in the table below.

| Connector Pin | 568A Wiring Conductor | 568B Wiring Conductor |
|---------------|--------------------------|--------------------------|
| 1 | White/Green | White/Orange |
| 2 | Green | Orange |
| 3 | White/Orange | White/Green |
| 6 | Orange | Green |
| 4 | Blue | Blue |
| 5 | White/Blue | White/Blue |
| 7 | White/Brown | White/Brown |
| 8 | Brown | Brown |

2. Shielded Cat-6 cabling shall be grounded on only one end of the cable.

3.2 CABLE TESTING

- A. After the network cabling has been installed, each network cable shall be tested.
- B. Test Equipment
 1. Unless specified otherwise, all test equipment for the calibration and checking of system components shall be provided by System Supplier for the duration of the testing work and this test equipment will remain the property of System Supplier.
- C. Ethernet UTP Cable Testing
 1. The System Supplier shall utilize the previously specified test equipment, and additional tools as needed to validate the Ethernet UTP cable installation. All test equipment shall bear current calibration certification from a certified calibration laboratory, as appropriate. Each cable shall be tested for open pairs, shorted pairs, crossed pairs, reversed pairs and split pairs. A check off sheet shall be utilized, shall be signed by the technician testing the cables, and shall be submitted for approval. Any identified faults shall be corrected at no additional cost.

End of Section

SECTION 40 68 83 - SOFTWARE CONTROL BLOCK DESCRIPTIONS

PART 1 - GENERAL

1.1 SCOPE

- A. This section provides functional descriptions of the PLC and computer software requirements for the Instrumentation and Control System as indicated on the Drawings. These descriptions are intended to provide an overview of the operating concept of the plant process equipment rather than describing in detail every operating feature or interlock.
- B. Control System
 - 1. The Instrumentation and Control System section shall apply to all systems described in this section.

1.2 SUBMITTALS

- A. See Section Instrumentation and Control System
 - 1. Submittals shall be as specified in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The descriptions are applicable to the existing software modifications as specified in the Instrumentation and Control System section.

PART 3 - EXECUTION

3.1 HMI FUNCTIONAL REQUIREMENTS

- A. The following paragraphs describe general configuration tasks that are required for the HMI and related software.
- B. Database
 - 1. The system database, including field I/O and internal points shall be modified according to the database point naming conventions approved by Owner. Database additions for field I/O shall include all required coordination with PLC level addresses.
- C. Trend Displays

Software Control Block Descriptions

1. Trend displays shall be developed to present real-time and historical process data in an X-Y graph format. Real-time trends shall utilize current process values to generate temporary graphs that do not retain data values. Historical trends shall utilize historically collected data and shall access the data files directly for use in the trend display. Historical trends shall allow paging forward and back to the limits of the collected data. The trending package shall be configured to automatically retrieve historical data from the proper data file to accommodate the paging functions. Content of the trends will be determined after meeting with Owner. Two real-time trend displays and two historical trend displays shall be provided.

D. Alarms

1. System alarming shall be configured for the new UV System. This shall include configuration of graphical alarm displays, and configuration of audible alarms through the HMI speakers. All process or system alarms shall appear on an existing alarm summary screen and the alarm banner of each new process graphic. Alarms and events shall be color coded on the alarm summary screen, with initial colors based on Owner conventions or the default colors associated with the graphics package. The colors may be adjusted after meeting with Owner. Alarm prioritizing and area assignments (if any) shall be coordinated with Owner at the first configuration meeting.
2. For LOW or LOW-LOW analog or discrete alarms which do not apply if associated equipment is not operating, provisions shall be made to prevent/Lock generation of the alarm unless the associated equipment is operating. This shall include alarms such as low amperage alarms for pumps that are not running. This may also include low flows or pressures when associated pumps are not operating (this will only apply if periodic operation of the equipment is considered normal).
3. All alarms/events shall be time stamped when displayed or printed. Unacknowledged alarms shall not automatically clear from the alarm summary if they return to normal before being acknowledged.

E. Reporting

1. System reporting shall be in accordance with the Instrumentation and Controls section.

F. Historical Data Collection

1. System data shall be collected for historical archiving and for use in trending and reporting functions. Requirements for data collection shall be as needed to support the trends and reports developed.

3.2 EQUIPMENT CONTROL AND CONTROL MODE OVERVIEW

- A. The following paragraphs explain the general format and control modes that are used in the detailed equipment descriptions. These paragraphs apply to the attached, project specific, equipment control descriptions included herein.

B. General

Software Control Block Descriptions

1. Appended to this section are the equipment control programming requirements, with requirements for both PLC programming and the minimum operator interface functions. The HMI requirements represent the anticipated display generation requirements and shall be adjusted if the PLC programming warrants adjustment.

C. Control Modes

1. There are two general control modes available for the process equipment: 1) remote manual, and 2) remote auto. Remote manual control provides a means for operators to adjust equipment status or setpoint, through the HMI, using manually initiated commands. Remote automatic control provides a means for automatically changing equipment status or setpoint based on measured process parameters, calculated values, or operator setpoints. Some equipment may have more than one remote auto mode.
2. Descriptions for local control are included in the detailed equipment control descriptions. They are provided primarily for documentation purposes and for information. These controls are hardwired and require no programming effort.

3.3 DETAILED EQUIPMENT CONTROL DESCRIPTIONS.

- A. The following paragraphs describe specific function requirements for various software control blocks in the control system. These descriptions are intended to provide an overview of the operational concept for the facilities, rather than describing in detail every operating feature or interlock.

3-3.1 UV Reactor Open/Close Gate Control

The UV Master Control Panel shall monitor and control operation of the motorized gates on the influent and effluent of the UV reactors. The number of active channels is determined by the influent flow rate as well as the UV dosage rate as calculated by the UV Master Control Panel. Channels are activated by opening their respective influent and effluent gates. Remote manual control via the Plant SCADA system shall be available through the HMI screens. The operator shall be capable of monitoring the gate positions and the gate actuator In Remote status, and shall be able to control the position of these gates using Open and Close selectable targets (remote manual control). Local control of each of these gates shall also be provided at the gate actuator.

Associated Equipment:

GSD-101, GSD-102, GSD-201, GSD-202

Associated PLC:

SCC-001 UV Master Control Panel

Associated Control Panels:

SCC-001 UV Master Control Panel

Associated P&ID:

Software Control Block Descriptions

I-101

Local Manual Mode:

Local manual control of the gate shall be provided at the actuator when the LOCAL-OFF-REMOTE selector switch is in the LOCAL position. The operator shall use the OPEN-STOP-CLOSE push buttons at the actuator to control the gate.

Local Auto Mode:

Local Auto control of the gate shall be provided through the UV Master Control Panel (SCC-001). When the L-O-R switch at the actuator is in the REMOTE position and AUTO control is selected at the SCC, the SCC shall automatically control the gate positions.

In all Auto and Remote control modes, SCC-001 shall generate a Gate Fail alarm if the Gate is commanded to Open or Close and the corresponding position limit switch feedback is not received within an adjustable time period, initially 30 seconds above the expected travel time of the gate.

Remote Manual Mode:

Remote manual control of the gate shall be provided through the SCC OIT or the Plant HMI. When the L-O-R switch at the actuator is in the REMOTE position, LOCAL control is selected at the SCC OIT, the operator shall have OPEN-CLOSE commands at the SCC OIT to control each gate position. When the L-O-R switch at the actuator is in the REMOTE position, REMOTE control is selected at the SCC OIT, and MANUAL control is selected at the HMI, the operator shall have OPEN-CLOSE commands at the HMI to control each gate position.

In all remote control modes, the UV control system shall generate a Gate Fail alarm if the Gate is commanded to Open or Close and the corresponding position limit switch feedback is not received within an adjustable time period, initially 30 seconds above the expected travel time of the gate.

Remote Auto Mode:

Not used.

Power Failure:

Upon loss of utility power, the gates shall remain in position. Upon regaining utility power, the gates shall operate as described above.

Alarms:

The SCADA HMI shall indicate the following alarms at a minimum:

- Gate Fail (PLC Generated, typical each gate)

Status Indications:

The HMI and OIT shall indicate the following statuses at a minimum:

- Gate Closed

Software Control Block Descriptions

- Gate Open
- Gate in Remote

Setpoints:

The HMI shall include the following setpoints at a minimum:

- Gate Fail Timer (0-600 seconds, initially 30 seconds above the expected travel time of the gate)

Trending:

- None

HMI Requirements:

The gate shall be depicted on the corresponding process screens. Displays shall be provided similar to the P&ID. The gate symbol shall be a selectable target which retrieves the respective overlay display. The overlay display shall contain control targets which allow selection of gate control mode (auto/manual) and manual control (open/close).

3-3.2 UV Disinfection System

A two-channel Trojan Signa UV system shall be installed to meet a UV transmittance (UVt) of 65 percent at 48 mgd. Each channel shall be equipped with 4 banks of 24 lamps per bank. The system shall be arranged to treat 46 mgd in two channels. Liquid level in each channel shall be maintained by a fixed weir. One on-line UVt measurement system shall be installed upstream of the UV channels. UVt measurements shall be used as part of the control system.

The UV reactor intensity shall be controlled by the vendor-provided UV Master Control Panel and individual local control panels in response to the plant effluent flow measured by an existing flow meter. The UV Master Control Panel shall monitor influent UV transmittance (UVt) and control each bank of UV cells according to their internal UV intensity (UVI) measurements and the influent UVt. The UV Master Control Panel shall communicate various signals to the SCADA system, including but not limited to Level, UVt, and UVI. Refer to the Open Channel Ultraviolet Disinfection System section for details.

Associated Equipment:

UV System, AE/AIT-001, AE/AIT-111, AE/AIT-121, AE/AIT-131, AE/AIT-141, AE/AIT-211, AE/AIT-221, AE/AIT-231, AE/AIT-241, LSSL-101, LSSL-201, FIT-600 (existing)

Associated PLC:

SCC-001 UV Master Control Panel

Associated Control Panels:

Software Control Block Descriptions

HSC-1A-1D, HSC-2A-2D, SCC-001, PDC-1A-1C, PDC-1D, PDC-2A-2C, PDC-2D, LCP-101, LCP-201

Associated P&ID:

I-101

Local Manual Mode:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

Local Auto Mode:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

Remote Manual Mode:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

Remote Auto Mode:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

PLC Powerup

On PLC Powerup, control of the UV Disinfection System shall be set to the local mode according to the local switch settings.

Power Failure

Utility Power Restoration: Once utility power has been confirmed restored, control of the UV Disinfection system shall resume with the control mode established prior to the power failure.

Alarms:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

Status Indications:

Refer to Section (46 66 56) Open Channel Ultraviolet Disinfection System

Setpoints:

The HMI and OIT shall include the following setpoints at a minimum:

- UV Dosage Setpoint
- Coordinate additional setpoints with UV System Supplier

Trending:

The following signals shall be recorded for trending at a minimum:

Software Control Block Descriptions

- UV Bank Running
- UV Bank Power
- UV Influent Flow
- UV Dose (millijoules per square centimeter)
- Lamp Cleaning Cycles and Frequencies
- UV transmittance (UVt)

HMI Requirements:

A UV overview screen shall be developed similar in look to the graphic screens on the Trojan UV control system touch panel.

3-3.3 HVAC System

The HVAC system monitors air temperature in the UV Building and reports a low air temperature alarm to the SCADA system.

Associated Equipment:

TCP-1

Associated PLC:

Existing PLC-CE

Associated Control Panels:

TCP-1

Associated P&ID:

I-101

Local Manual Mode:

None.

Local Auto Mode:

None.

Remote Manual Mode:

None.

Remote Auto Mode:

Software Control Block Descriptions

None.

PLC Powerup

On PLC Powerup, monitoring of the low temperature alarm will resume.

Power Failure

Utility Power Restoration: Once utility power has been confirmed restored, control shall resume with the control mode established prior to the power failure

Alarms:

Low Temperature Alarm

Status Indications:

None

Setpoints:

None

Trending:

None

HMI Requirements:

A low room temperature alarm graphic shall display on the UV overview screen and be annunciated through the HMI.

End of Section

Panel Mounted Instruments

SECTION 40 78 00 - PANEL MOUNTED INSTRUMENTS

PART 1 - GENERAL

1.1 SCOPE

- A. The Panel Mounted Instruments section covers the furnishing of all panel mounted instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.
- B. Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.
- C. When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1.2 DESIGN CRITERIA

- A. The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or the Instrument Device Schedule.
- B. Where possible, each instrument shall be factory calibrated to the calibration ranges indicated on the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. For "smart" devices, calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings and/or Instrument Device Schedule.

1.3 SUBMITTALS

- A. See Section Instrumentation and Control System section.
 - 1. Submittals shall be as specified in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The following paragraphs describe minimum device stipulations. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.
- B. Programming Device
 - 1. For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training stipulations. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.
- C. Configuration Software/Serial Interface
 - 1. Devices indicated as requiring a serial interface shall be provided with all accessories to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a laptop computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under the Windows 10 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device need not be furnished.

2.2 PANEL INTERIOR MOUNTED DEVICES

- A. Power Supplies
 - 1. Regulated dc power supplies for instrument loops shall be designed and arranged so that loss of one supply does not affect more than one instrument loop or system. Power supplies shall be suitable for an input voltage variation of ± 10 percent, and the supply output shall be fused or shortcircuit protected. Output voltage regulation shall be by the instrumentation equipment supplied. Multiloop or multisystem power supplies will be acceptable if backup power supply units are provided which will automatically supply the load upon failure of the primary supply. The backup supply systems shall be designed so either the primary or the backup supply can be removed, repaired, and returned to service without disrupting the instrument system operation. Multiloop power supply connections shall be individually fused so a fault in one instrument loop will be isolated from the other loops being fed from the same supply. Fuses shall be clearly labeled and shall be located for easy access. Multiloop supply systems shall be oversized for an additional 10 percent future load. Failure of a multiloop supply shall be indicated on the respective instrument panel or enclosure.
 - 2. Power supplies shall be Allen Bradley, Phoenix Contact, PULS, or equal.

Panel Mounted Instruments

B. Electronic Signal Splitters

1. Electronic signal splitters shall have all solid-state circuitry and complete electrical isolation between the power supply and the input and output signals. Accuracy shall be ± 0.15 percent of span. Splitters shall be manufactured by Acromag, Moore Industries-International, Inc., or Phoenix Contact.

PART 3 - EXECUTION

3.1 FIELD SERVICES

- A. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section. Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section

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Section 46 66 56 – OPEN CHANNEL ULTRAVIOLET DISINFECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the general design requirements, materials, and product data, installation assistance, startup, and commissioning for an open channel Ultraviolet (UV) disinfection system. The UV disinfection system has been preselected by the Owner to be installed as part of this Project. The selected UV System Supplier (UVSS) scope of services as well as items described in the Contract Documents, including price, will be sole-sourced to Trojan Technologies. The accepted shop drawings and scope of services are included in Attachments A and B, respectively. Additional requirements for equipment and performance testing are specified in other sections. Contractor is responsible for installation and coordination of all equipment and materials provided by the UVSS.
- B. The UVSS shall provide all parts (sensors, probes, controls), equipment, sluice gates and electric actuators, materials, components, installation assistance and performance testing required for a complete and functional system with an integrated cleaning system.
- C. The UVSS shall coordinate requirements for system installation with the Installation Contractor and Engineer including the following:
 - 1. Channel dimensions
 - 2. UV system headloss
 - 3. UV system installation instructions
 - 4. UV control system requirements for integration into the Plant Instrumentation and Control System (PICS)
 - 5. Performance testing requirements
- D. The UVSS shall submit the specified information to the Engineer for the design of the facilities associated with the supply of the UV system. Installation Contractor will be responsible for providing all data/communication cables/wires required for the connection of the UV system to the PICS.
- E. The UV system shall be an open channel, gravity flow system utilizing a staggered arrangement, low pressure, high intensity lamps. The UV system shall include but not limited to the following principal required components:
 - 1. UV lamp banks with quartz sleeves
 - 2. Lamp assemblies on removable banks
 - 3. Low pressure high output lamps

Open Channel UV Disinfection System

4. Automatic quartz sleeve cleaning system
5. Influent and effluent channel isolation gates, with electric actuators
6. UV system influent level control
7. Online UV intensity measurement
8. Integrated lifting device for UV banks
9. Drivers to operate UV lamps
10. Ballast (Driver) Cabinets Interconnecting power cables between UV banks and UV power/control equipment. Data cables will be provided by the UVSS and installed by Installation Contractor
12. System instrumentation and controls including programmable logic controller (PLC)
13. On-line UV transmittance sensor, UVT monitor, submersible probe with mounting kit, controller, and 75 ft of cable between the probe and controller.
14. UV eye shields and personnel safety equipment
15. Accessories
16. Spare parts
17. Special tools, whether specifically mentioned in this Section or not, as required for a complete system
18. Control panel

1.2 GENERAL

A. Coordination.

1. Equipment furnished and installed under this Section and the associated sections shall be fabricated, assembled, erected, placed in proper operating condition, and tested in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment provided by the UVSS. The Contractor shall execute this coordination under the construction contract.

B. General Equipment Stipulations.

1. The General Equipment Stipulations shall apply to all equipment furnished under this Section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

Open Channel UV Disinfection System

C. Seismic Design Requirements.

1. Seismic Design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section. UVSS shall utilize a licensed Professional Engineer in Michigan, as necessary, to meet these requirements.

D. Governing Standards.

1. Except as modified or supplemented herein, all work covered by this Section shall be performed in accordance with all applicable municipal codes and ordinances, laws, and regulations which pertain to such work. In case of a conflict between these specifications and any state law or local ordinance, the latter shall govern.
2. All work shall comply with Underwriters' Laboratories (UL) safety requirements.

E. Power Supply.

1. The UV system shall be rated for a 480 / 277 volt, 3 phase, 4 wire + ground, and a 60 Hz power supply. Power supply to the UV system will be provided via 480V switchgear connections distributed to the UV System via 150kVA isolation transformers, and local disconnects. If additional power supply adjustments are needed, Engineer's Approval is required and UVSS shall state this requirement with their submittal.
2. Control system shall be a 120 volt, 1 phase, 60 Hz supply.
3. A hydraulic or electric cleaning system shall be acceptable.
4. Installation Contractor is responsible for cable and raceway supplying electrical power and control to the UV equipment. Lamp drivers are located in the Ballast (Driver) Cabinets located beside the UV channel. UVSS is responsible for providing the electrical design supply and construction from the external power and control interconnections to the equipment and accessories specified herein.

F. Tagging and Identification.

1. Each item of equipment and each part shipped separately shall be tagged and identified with indelible markings for the intended service. Tag number shall be clearly marked on all shipping labels and on the outside of all containers.
2. Equipment specified herein and in associated sections shall be identified in accordance with the Equipment and Valve Identification section.

G. Definitions.

1. The following terms are used in this Section and associated sections:
 - a. UV Dose – The total radiant energy incident from all directions onto an infinitesimally small sphere of area dA , divided by dA , for a given contact

time in seconds. The unit of UV dose shall be millijoules per square centimeter (mJ/cm^2) and shall be calculated as follows:

$$= I \times t$$

Where: D = UV Dose, $\text{mW}\cdot\text{s}/\text{cm}^2$ (mJ/cm^2)
 I = average intensity or irradiance, mW/cm^2
 t = average exposure time, s

- b. UV Transmittance (UVT) – The transmittance of ultraviolet light at a wavelength of 254 nm through the water across a pathlength of 1 cm. UV transmittance shall be calculated from UV absorbance (A) at 254 nm by the following equation:

$$\text{Percent transmittance} = 100 \times 10^{-A}$$

- c. Intensity or Irradiance – The total radiant power incident from all directions onto a infinitesimally small sphere of cross-sectional area dA , divided by dA . The units of intensity shall be milliwatts per square centimeter (mW/cm^2).
- d. Validated Reactor – A reactor that has been validated under the following conditions.
- 1) The validated flow range contains the design flow range per reactor as stated in this Section.
 - 2) The validated UVT range contains the operational UV transmittance range as stated in this Section.
 - 3) The validated dose range contains the operational germicidal UV dose range as stated in this Section.
- e. Equivalent Dose – The maximum dose necessary for a full-scale UV system to achieve a level of inactivation of a specific organism equivalent to the level of inactivation for the same organism achieved in a laboratory using a collimated beam apparatus with a low pressure lamp producing UV energy at a wavelength of 254 nm to test a water sample collected at the same time.
- f. Low Pressure High Output (LPHO) Lamp – A lamp with input power equal to two to three times the input power of a LP lamp, primarily at 254 nm, with a pressure of approximately 0.2 psi.
- g. Guaranteed Life – The UVSS’s warranted life of the lamp, sleeve, ballast, and sensor.
- h. Expected Lamp Life – The UVSS’s estimated life of the lamp based on the operating conditions described in this Section.
- i. Prorated Start Time – The time beginning after at least 20 percent of the guaranteed life has lapsed.
- j. Guaranteed Maximum Total System Energy Use – A calculated value based on UVSS data reflecting energy use in kilowatt-hours per year.
- k. Guaranteed Maximum Head Loss – The head loss in inches of water column allowed through the UV channel with all restrictions, including fouling, influent gate, and level control at peak flow rate.
- l. Gallon – U.S. gallon.

1.3 SUBMITTALS

- A. The engineering data submitted by the UVSS and included herein will be verified during the performance testing of the system and prior to the acceptance of the equipment by the Owner. Any exceptions or deviations to these specifications shall be listed and fully described in the submittal. The Engineer's final decision regarding the acceptance or denial of any deviations or exceptions shall be just cause for the rejection of the proposed equipment and require that the UVSS provide the disinfection equipment as specified herein.
- B. Unless otherwise noted submittals required herein are considered part of the Early Works cost.
- C. Drawings and Data.
 - 1. Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, were submitted by the UVSS. Data and specifications include the following:
 - a. Complete description in sufficient detail to permit an item-by-item comparison with the Specification.
 - b. Dimensions and installation requirements of all required elements.
 - c. P&IDs of the system, detailing the equipment supplied by the UVSS and showing equipment to be provided by others that will interface with the system. The UVSS shall identify tag numbering for the units and the system that is coordinated with the Owner's established tag numbering scheme. An electronic copy of the PLC input/output listings in an Excel spreadsheet shall also be submitted to the Owner for programming of the SCADA interface. Input/output listing shall include all local alarms, and shall identify which alarms indicate that the UV system has been shut down.
 - d. Descriptive information, including catalog cuts and UVSS's specifications for major components. Information shall include weight and dimensions of major equipment and materials.
 - e. Bill of Materials after shop drawings are accepted, for all tagged devices and components supplied with the UV System including component original part numbers identifying each furnished component. For all tagged devices supplied, the UVSS shall develop a "Cross Reference Schedule" that matches the Tag to the appropriate equipment manual. The equipment schedule shall include the pertinent information associated with the equipment including tag number, description, functional name location, component equipment model, part number, size, materials, accessories and range. The Cross-Reference Schedule shall be provided in the form of a Microsoft Excel spreadsheet.
 - f. Electrical schematics, wiring diagrams and plan layouts. Drawings shall provide details for all field-wiring requirements between the UV system control panels and externally mounted equipment.
 - g. Detailed, site specific narrative information on how the UV system will operate and list of maintenance requirements.

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- h. The UVSS will provide documentation of previous experience with municipal UV disinfection systems in wastewater applications with variable output electronic drivers and automatic cleaning system.
 - i. Calculations showing power required to achieve the disinfection requirements specified herein. The UVSS shall state the power per lamp (including lamp driver loss) and the system peak power consumption (including lamp driver loss), for both new lamps and end of lamp life.
 - 1) UVSS shall calculate and submit for Engineer review the maximum UV dose able to be delivered at peak flow condition and other design criteria defined herein with one UV bank in each channel out of service.
 - j. Independent third party certified test results for power (kW), power factor, and apparent power (kVA) for the entire system.
 - 1) These costs shall be provided under the Balance of the Work costs.
 - k. Hydraulic calculations demonstrating compliance with the specified head loss through the channel with all restrictions, weirs, and controls factored in at all flow conditions specified herein.
 - l. Minimum UV254 transmission of the quartz sleeves and their guaranteed useful life as based on third party certification.
 - m. Certification from UV lamp and lamp driver output report prepared by an independent testing laboratory for the UVSS's current lamp technology. The report shall certify the output of the lamp and ballast at various operating conditions.
 - n. Guaranteed operating life of lamps in hours and lamp driver in years.
 - o. Certification of the specified guaranteed cost of replacement lamps for five years.
 - p. Certification dose response curve, bioassay test information transmittance measurements, and all supporting documentation utilized in submittals based on effluent samples where collected by the UVSS for system design.
 - q. UVSS commissioning test protocol, included in the Early Works cost. Additionally costs for updates in the Balance of the Work shall be included.
 - r. UVSS's project specific performance testing protocol that is in conformance with this Specification.
 - s. Description of disinfection performance guarantee
 - t. Temperature rise versus time table
 - u. Data on Shop Coating
2. Values submitted for headloss and power consumption will be verified during the performance and commissioning testing of the equipment, and prior to acceptance of the equipment by the Owner.

D. Operation and Maintenance Manuals.

- 1. One electronic copy of the operation and maintenance (O&M) manuals shall be submitted with the delivery of the equipment to the Owners treatment plant. The O&M manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered. In addition to requirements specified,

the operation and maintenance manuals shall include but not be limited to the following:

- a. General description of the UV system as required by the UVSS.
- b. UVSS contact information.
- c. Recommended routine and preventive maintenance schedules.
- d. Step-by-step procedure for cleaning lamps, sensors, and reactors, including the volume of cleaning chemical required to clean one reactor and expected cleaning frequency given the water quality constituents. Procedure for maintaining lamps, sensors, lamp drive, and reactor.
- e. Guide to troubleshooting.
- f. Upon completion of installation and startup of the equipment, electronic copies of the PLC control programs and OIT programs shall be submitted to the Owner.

1.4 QUALITY ASSURANCE

A. Qualification Requirements.

1. The UVSS shall be regularly engaged in the manufacture of UV systems and shall have at least five Low Pressure High Intensity (LPHI) systems of the same model of 30 mgd or greater capacity, installed and operating in the United States.
2. The UVSS shall have 3 years of operational experience for UV systems of the same model proposed.
3. All equipment furnished under this specification shall be new and shall be the standard product of a supplier who is regularly engaged in the supply of the equipment to be furnished.

B. Performance Requirements Guarantee.

1. The performance of the UV system in accordance with the requirements specified herein shall be guaranteed by the UVSS.
2. The UV validated dose produced by the system shall be in accordance with the specified requirements and shall be verified by a bioassay conducted according to either NWRI Ultraviolet Disinfection Guidelines for Drinking Water and Reuse Water (2012) or Ultraviolet Disinfection Guidance Manual (2006) procedures. A copy of this certification letter showing approval by the State of California shall be submitted. Cost of any additional validation work required to meet the requirements of this specification shall be at UVSS cost.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1.6 SPARE PARTS

- A. A set of spare parts shall be furnished and delivered with the system. UVSS shall provide spare parts for 10 percent of the overall installed system. Spare parts should include but not be limited to lamps, wipers, sleeves, and ballasts.
- B. Spare parts shall be delivered to Owner as directed. All spare parts shall be in waterproof packages suitable for export service, labeled with the description and part numbers. Each item or set of parts expected to be installed at one time shall be in an individual package.
- C. If any of the above spare parts are used during the installation process, they shall be replaced at no cost to the Owner.

1.7 WARRANTY

- A. The equipment furnished under this Section shall be free from defects in materials and workmanship, including damage that may occur during shipping, for a period of 1 year from the date of Substantial Completion for the construction contract regardless of the date the equipment is manufactured or delivered to the site.
- B. Lamps shall be warranted for a guaranteed lamp life of 15,000 hours based on actual operating hours, to produce a delivered dose as indicated by the control system provided by the UVSS, to achieve compliance with permit requirements. Replacement cost will be prorated after 9,000 hours. On/Off cycles are limited to an average of four (4) per day accumulate over the guaranteed life of the lamp.
- C. Lamp drivers shall be warranted for a guaranteed life of 5 years from Substantial Completion regardless of the power output and operating hours. The lamp driver shall be replaced free of charge if it fails within one calendar year after Substantial Completion for the construction contract. The UVSS shall provide replacement of failed lamp drivers within 30 days after written notification from the Owner, at no additional cost to the Owner. If the lamp driver fails after the first (1st) and before the tenth (10th) anniversary of the date of Substantial Completion, the UVSS shall provide a replacement lamp driver at a prorated price.
- D. Quartz sleeves shall be warranted for a minimum of 10 years from Substantial Completion. If 20 percent of the quartz sleeves fail to maintain a minimum transparency factor of 0.92 during the 10 year period, the UVSS shall replace all quartz sleeves within 30 days after written notification from the Owner, at no additional cost to the Owner. The full replacement of quartz sleeves does not apply if the failures can be shown to be no fault of the manufacturer or if they are a result of the system not being operated in accordance with the UVSS operation and maintenance manual. Shipping of quartz sleeves will be at UVSS expense.
- E. Intensity sensors shall be warranted for a minimum of 5 years from Substantial Completion prorated after 1 year. The full replacement of the intensity sensors does not apply if the failures can be shown to be no fault of the manufacturer or if they are a result of the system not being operated in accordance with the UVSS operation and maintenance manual.

- F. The warranty for lamps, lamp drivers, sensors, and quartz sleeves shall include all parts and freight for replacement during the warranty period. A written warranty acceptable to Engineer and Owner shall be provided.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. The ultraviolet disinfection banks shall be installed within concrete channels. The UV system will be used to disinfect wastewater which has undergone screening, grit removal, primary clarification, activated sludge treatment, final clarification, and under most conditions, filtration.
- B. All electrical and control equipment enclosures will be installed indoors. The ambient temperature where the equipment will be installed will be between 33 and 104 degrees F. The operating ambient relative humidity is expected to be between 5 percent and 95 percent.
- C. Seismic design requirements shall be in accordance with the Meteorological and Seismic Design Criteria section.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The equipment shall be designed for installation in concrete channels with dimensions as indicated on the Drawings.
- B. The end of lamp life UV dose produced by the system shall not be less than the value specified herein, as measured after the guaranteed lamp life indicated by UVSS has passed, in an effluent with UV transmittance as indicated in the design requirements at 253.7 nm at peak flow with fouled sleeves at the end of lamp life.
- C. The UV system shall be designed for the following performance and design requirements:

| | | |
|---|----|-----|
| Peak flow (with all channels in service) | 54 | mgd |
| Average daily flow | 26 | mgd |
| Minimum daily flow | 10 | mgd |
| Minimum number of channels | 2 | |
| Estimated UV Transmittance (at 253.7 nm through 1 cm deionized water) through flow tubes, for design sizing | 60 | % |

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| | | |
|--|-----------------|--------------------|
| Min. UV validated dosage, at design conditions, after minimum number of hours (as indicated by guaranteed lamp life of operation and adjusted for organism) based on MS2 phage | 30 ¹ | mJ/cm ² |
| Lamp Output at End of lamp life, | 86 ² | % |
| Fouling factor | 94 ² | % |
| Maximum daily effluent CBOD, permit | 30 | mg/L |
| Influent plant <i>E Coli</i> coliforms/100 mL | ~2,000 | cfu/100 mL |
| Monthly effluent fecal coliform/100 mL, permit (based on 30-day geometric mean) | 200 | cts/100 mL |
| 7-Day effluent fecal coliform/100 mL, permit (based on geometric mean) | 400 | cts/100 mL |
| Wastewater temperature range | 10 to 30 | °C |
| Maximum Monthly Effluent TSS, permit | 30 | mg/L |
| Maximum Weekly Effluent TSS, permit | (7-day avg.) 45 | mg/L |
| Bioassay required to verify validated dose | Yes | |
| Maximum allowable headloss from furthest upstream UV bank to top of the weir | 8 | Inches |

Notes:

1. The UV system shall be designed to deliver a minimum UV dose specified at peak flow, in effluent having the specified UV transmittance, at end of lamp life (EOLL) after reductions for quartz sleeve fouling.

2. The UV Dose shall be adjusted using the end of lamp life factor as specified in the design requirements table to compensate for lamp output reduction over the time period corresponding to the manufacturer's lamp warranty. Any change to specified EOLL shall be provided to the Engineer for approval at a minimum of 15 days before bidding for acceptance. Documentation of EOLL will be provided by the UVSS.

D. Redundancy

1. The UV system shall include a redundant bank in each channel for redundancy.

2.3 EQUIPMENT BASIS OF DESIGN

- A. This specification Section describes a complete operational system to be furnished by a single responsible UVSS.
- B. Quality Assurance.
 - 1. The products covered by this specification are intended to be the standard equipment, as modified by these specifications, of proven ability, and as manufactured by a single manufacturer, having long experience in the production of such equipment. UVSS shall be manufactured by Trojan Technologies of London, Ontario, without exception.

2.4 CONSTRUCTION

- A. The following paragraphs specify general requirements.
- B. No tools or special equipment shall be required for bank removal.
- C. All wetted parts shall be AISI Type 316 stainless steel, quartz glass, Teflon, or plastics not susceptible to UV or chemical degradation, including oxidants. All metal components above the water surface shall be AISI Type Type 316 stainless steel. All wiring exposed to UV light shall be insulated with UV-resistant material and warranted for 5 years from Substantial Completion for both parts and labor. All material exposed to UV light shall be Type 316 stainless steel, Type 214 quartz, Teflon, or other material acceptable to the Engineer.
- D. UV Lamps.
 - 1. The UV system shall utilize low pressure, high-intensity, mercury amalgam lamps capable of variable control of power output from a minimum of 50 to 100 percent installed in a staggered arrangement. Each lamp shall be protected from contact with the fluid by a quartz sleeve. Lamp filaments shall withstand shock and vibration.
 - 2. Electrical connections for the lamp will consist of four pins at one end of the lamp only. Lamp wiring shall be Teflon insulated stranded wire. Lamps without maintenance coating or that do not have four pins are considered instant-start and are not acceptable due to reduced reliability and increased maintenance and operating costs. The lamp shall withstand an average of four on/off cycles per day without reducing lamp life, warranty or causing any damage to the lamp.
 - 3. Lamp bases shall be resistant to UV, ozone, chlorine, and chloramines. UV lamps shall not require a long cool down period prior to re-start should the power to the UV system fail or be interrupted for a short period of time.
 - 4. The UV system lamps shall be available from the UVSS and preferably at least two lamp suppliers. No modifications to the system shall be required for lamp installation. Lamp replacement costs shall be guaranteed for a minimum of 10 years from the date of Substantial Completion for the Project. During these

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10 years, the price shall be adjusted annually by the Producer Price Index – Industrial Commodities (where the base is 1982 = 100) published by the United States Department of Labor, Bureau of Labor Statistics, applicable on the anniversary of the date for Substantial Completion.

5. The UVSS shall provide independent laboratory certification that lamps will provide a minimum of 35 percent of input power emitted as UV light at a wavelength of 254 nm after 100 hour burn-in period, and at the maximum lamp operating temperature. The lamp temperature shall not exceed the maximum operating temperature under full scale, full power conditions for this Project.
6. Lamp output shall not fluctuate more than 3 percent with water temperature variations over the specified range. The operating skin temperature of the lamp shall not exceed 130° C. UV lamp maximum arc shall be as defined by each supplier. The lamps shall be capable of operating in a “No Flow” condition while submerged in water at the maximum specified process temperature, for a period of 60 minutes without causing any damage to the lamps.
7. Lamps will be operated by electronic lamp drivers with variable output capabilities ranging from a minimum of 50 percent to 100 percent of normal power. The lamp assembly shall incorporate active filament heating to maintain a minimum lamp efficiency of 35 percent across the varying water temperatures and between the minimum and maximum stated lamp power levels.

E. UV Banks.

1. UV Banks shall consist of UV lamps mounted on a heavy gauge Type 316 stainless steel frame. Lamp sleeves shall be provided around each UV lamp to prevent the lamps and electrical connections from coming in contact with the wastewater effluent. Lamp sleeves shall be single piece clear fused quartz circular tubing. Each lamp will be enclosed in its individual quartz sleeve, one end of which will be closed and the other end sealed by a lamp end seal. The closed end of the quartz sleeve will be held in place by a retaining O-ring. The quartz sleeve will not meet any steel in the frame. Sleeves will have minimum UV transmittance at 254nm of 90 percent. Sleeves will be open at one end only and domed at the other end. Quartz sleeves shall be clear fused quartz circular tubing containing 99.9 percent silicon dioxide.
2. The ends of lamp sleeves shall not protrude beyond the stainless steel frame of the UV bank. Type 316 stainless steel spacer/reflector panels shall be provided so that no UV light is emitted from the channel when the UV banks are installed, and the lamps are energized. Each bank will be Type 6P or IP 67 rated.

F. Electronic Lamp Driver.

1. The electronic lamp driver shall drive one or a pair of lamps with independent control and monitoring circuits, and provide independent lamp status to the UV system PLC. The lamp driver shall be electronic microprocessor controlled.
2. The lamp driver shall produce an earth free lamp power supply operating at above supply frequency and optimized to preserve lamp life. The lamp driver will be

programmed start type utilizing filament preheat followed by a high voltage pulse to ignite the lamp.

3. The lamp driver shall have a power factor correction circuit to ensure a maximum 99 percent power factor and less than 5 percent total harmonic distortion (THD) current at the maximum power level and nominal input voltage. The lamp driver electrical efficiency shall be a minimum 95 percent at maximum power level.
4. The lamp driver shall detect lamp failure and automatically initiate a re-start sequence. The lamp driver shall attempt at least three re-starts before shutting off. The lamp driver shall incorporate a galvanic separation of the circuits for the two lamps served. In case of the secondary circuit operating in abnormal conditions regarding voltage and/or amperage, the lamp driver shall shut the affected lamp off.
5. The lamp driver shall be held in a standby mode when not in operation to reduce start-up time and minimize stress on electronic components. Local visual diagnostic will be provided with LEDs for lamp drive status, lamp status (on, idle, preheat, fault) power and communications status. Lamp driver shall be UL, CE, and RoHS compliant.

G. Cleaning System.

1. An automatic and integral lamp cleaning system shall be provided as part of the UV system. The cleaning system shall be designed to effectively and completely remove deposits from the lamp sleeves. The cleaning system shall be fully operational without requiring either lamps or banks to be removed from service.
2. The cleaning system will be provided with the required solutions to provide adequate cleaning, if capable of chemical and mechanical in-situ cleaning.
3. The wipers shall travel the full length of UV lamp arc. Cleaning system servicing will be provided so that servicing can be conducted while the system is operational. Wiping sequence will be automatically initiated with capability for manual override.
4. The UV intensity sensor shall be cleaned utilizing the same mechanical cleaning method as that of the lamp quartz sleeves. The cleaning system shall be parked out of the effluent when not in service.
5. The materials used for the wiper shall be resistant to high intensity UV radiation, wastewater, chemicals in the wastewater, and fluctuations in temperature.

H. Channel Level Control.

1. Level in the UV channel shall be controlled by fixed level control weir troughs provided by the UVSS. The weirs shall be sized appropriately to keep the proper level on the UV lamps while minimizing upstream head conditions. The space is constrained by the length of the existing weir plates. If additional weir length is required, UVSS shall provide proposed layout to increase weir length while minimizing modifications to the outer concrete walls. The weir troughs shall be

constructed from AISI Type 304 stainless steel or be provided with Type 304 stainless steel weir plate for mounting to concrete. Installation Contractor will be responsible for all leveling of the weir troughs during installation.

I. Equipment Tags.

1. All equipment provided by the UVSS shall have a unique tag number. UVSS shall coordinate tag numbers with the Engineer and Owner.

2.5 ACCESSORIES

- A. Lifting Eyes. All equipment weighing more than 100 pounds shall be provided with lifting eyes. Where a special lifting sling is required, it shall be furnished.
- B. Safety Equipment. Safety equipment consisting of 10 personnel goggles/face shields for protection against UV energy between 200 to 400 nm wavelength shall be provided. Eight UV area warning signs shall be provided. Refer to Owner requirements for warning sign locations.
- C. Electrical and Control Equipment Enclosure(s) Cooling. Where required by the UVSS's equipment when installed in the ambient conditions specified herein, the UVSS shall provide an air conditioning system, that will adequately cool the system electrical and control equipment enclosures. The air conditioning system components outside of the enclosure shall be constructed of corrosion resistant materials and provided with a phenolic epoxy coating. The air conditioning equipment shall be sized to accommodate any reduction in cooling capacity caused by the coating. Under no circumstances shall the panel cooling or heating equipment compromise the NEMA rating of the panel.
- D. UV Bank Integrated Lifting Device. The lifting device for UV Banks will be supplied by the UVSS. The integrated lifting device should be designed and supplied to facilitate lifting a UV bank from the channel without use of ancillary equipment. The lifting device should be integrated into the UV Bank for simple and seamless operation. The UV bank will be raised from the channel for easier access and maintenance. The lifting device design should provide access to components without having to break electrical connections thus reducing wear on connectors.

2.6 ELECTRICAL

- A. The UVSS shall provide harmonic order and harmonic generation data of the UV system. UVSS shall also provide the data regarding harmonic transferred to primary side of UV power supply isolation transformer.
- B. The UV disinfection system shall be divided into electrical sub-systems. Each sub-system shall be powered from the Ballast (Driver) Cabinet by means of waterproof cable interfacing with a watertight strain relief. Electrical supply to each Ballast (Driver) Cabinet shall be 480/277 volts, 3 phase, 4 wire + ground, 60 Hz.
- C. Ballast (Driver) Cabinet enclosure shall be Type NEMA 4X construction, AISI Type 316 stainless steel. All internal components will be sealed from the environment. All

Ballast (Driver) Cabinets shall be UL approved or equivalent. An internal heater shall be provided in the Ballast (Driver) Cabinet to prevent condensation when the external temperature drops below the dew point. Each Ballast (Driver) Cabinet shall be able to electrically isolate each bank of lamp drivers and safely replace a lamp driver without de-energizing any other operating banks.

- D. The control cabinets required to operate the automatic cleaning system and integrated lifting device shall be Type NEMA 4X, AISI Type 316 Stainless. The frequency of cleaning shall be adjustable at the Operator Interface on SCC-001. The cleaning system shall be hydraulically actuated by Channel 1 Hydraulic System Center (HSC-1A-1D) and Channel 2 Hydraulic System Center (HSC-2A-2D). The HSCs each shall contain a hydraulic power unit complete with pump, fluid reservoir, manifolds, valves and filter.
- E. General Wiring and Connections Requirements.
 - 1. All wiring and electrical connections shall be protected against moisture to prevent electrical shorts or failure. All electrical components, installation, wiring, and controls on or within the UV disinfection system as a whole shall be designed, constructed, and installed by the UVSS and in accordance with the current edition of the National Electrical Code and all applicable state and local electrical codes.
 - 2. The UV system banks shall be completely wired, requiring only an external connection for a single external power supply and monitoring and control wiring.
 - 3. External wiring to and from the control panel, except as noted, and power disconnect and alarm circuits shall be furnished and installed under the Electrical section by the Contractor under the construction contract. Wiring between the Ballast (Driver) Cabinet and the ballast and lamp enclosures will be provided under this Section. UVSS shall provide the wiring from the ballasts to the lamps. If terminations are needed in the field between the lamps and ballasts, they shall be performed by the Installation Contractor and tested by the UVSS.

2.7 CONTROL AND INSTRUMENTATION

A. General.

- 1. The UV system shall be provided with a Master Control Panel (SCC-001) furnished by the UVSS. The panel shall be a NEMA 4X, Type 316 Stainless Steel, front opening, free standing panel with a full length door hinge and three point latch. The panel shall be designed for top and bottom entry of field wiring.

B. Power Supply.

- 1. The Master Control Panel shall accept a 120 volt, 60 Hz, single phase power supply. The panel shall be protected by a circuit breaker with an interrupting rating of 10,000 amps.

C. Power and Control Wiring.

1. The UVSS shall furnish all power and data cabling between the UV banks and the Ballast (Driver) Cabinets. The incoming power supply, conduit, and all field terminations and interconnections for power and data cables will be the responsibility of the Installation Contractor. Cables shall be installed by the Installation Contractor.
2. Conduit for all power, data, control, and instrumentation field wiring and cable shall be provided and installed by Installation Contractor.

D. Diagnostics Port.

1. The Master Control Panel shall include an ethernet switch connected to the PLC that will allow the UVSS to access the PLC program for troubleshooting.

E. Programmable Logic Controller.

1. A programmable logic controller (PLC) shall be provided in the Master Control Panel for control of the UV system. Inputs/Outputs (I/O) will be 24VDC for digital signals and 4-20 mA DC for analog signals. The PLC shall be programmed for the functional control described herein, and incorporating sequences and safety and equipment protective interlocks as recommended by the UVSS.
2. The PLC shall be connected to the PICS Ethernet network, and the Contractor shall provide the required communication banks. The UVSS shall coordinate requirements with the I&C System Supplier for communication between the UV system PLC and the PICS. The plant SCADA system is a Rockwell FactoryTalk View Studio SE Version 12 (network distributed system). It uses PlantPax 3.0 (Built in PLC program file) which has pop-up screens for each device (pumps, valves and analog signals). The UV PLC shall be an Allen-Bradley ControlLogix controller model 1756-L73 with minimum 8MB of memory and RSLogix 5000 software (latest version) compatible with plant SCADA. The UV PLC shall use 24VDC discrete I/O cards and communicate with the PICS/SCADA system via EtherNet/IP protocol over a CAT6 cable.

F. Operator Interface Terminal.

1. A Beijer 15-inch operator interface terminal (OIT) will be provided in the UV Master Control Panel. This OIT will have a nominal diagonal display dimension of at least 15 inches with a minimum resolution of 640x480, 256 K colors, and a luminance of 400 cd/m² shall be provided. The OIT shall be NEMA 4X, and shall be mounted on the Master Control Panel face. The OIT shall display indications and alarms as recommended by the UVSS and as specified herein. A touch screen with pop up keyboard shall be provided for operator entry of commands and setpoints.

G. UPS.

1. A UPS shall be provided within the control panel to provide backup power to the PLC, OIT, and Ethernet switch for at least 30 minutes when power is lost to the

control panel. The UVSS shall be responsible for providing a properly sized UPS, installing the UPS in the control panel, and providing all necessary hardware and wiring to ensure a fully functional UPS backup system. Upon restoration of incoming power, the UPS shall recharge the batteries and return its connected loads to the incoming power source.

2. The UPS shall maintain a temperature-compensated, float charge voltage on the batteries when utility power is available to the UPS. Overcurrent protection when utility power is available shall be from a circuit breaker internal to the UPS. The UPS shall be intrinsically current-limiting when the unit is on battery.

3. The UPS shall meet the following requirements.

| | |
|--|--|
| Capacity, minimum | 1500 VA |
| Filtering and surge Protection (on utility power) | Meets UL 1449 |
| Operating environment | 0 to 40°C; 0 to 95 percent relative humidity, non-condensing |
| Recharge time, maximum (from 50 percent battery state of charge) | 8 hours |

4. The UPS shall have a visual status indicator for low (or faulty) battery, incoming power failure, on battery, and overload conditions. The UPS shall emit an audible signal when the UPS is operating on battery power. UPS alarms shall also be available and annunciated in the PLC.

H. Programmable Logic Controller and Operator Interface Terminal Configuration.

1. The UV control system shall be configured and commissioned by the UVSS for operation of the system as specified herein and as required by the UVSS.
2. The UVSS shall be responsible for programming all pseudo-I/O or transfer registers plus providing memory for 25 percent spare pseudo-I/O. All pseudo-I/O plus the 25 percent spare shall be located in a contiguous block of data registers for communication to the PICS.
3. All control mode status, control set points, equipment status, bank elapsed time, alarm and data points in the UV system shall be made available on OIT screen. Full control of the UV system shall be provided through the OIT.
4. The OIT display should include, but not be limited to the following:
 - a. UV system in LOCAL ON
 - b. UV system in LOCAL OFF
 - c. UV system in REMOTE OFF
 - d. UV system in REMOTE ON

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- e. UV system in REMOTE AUTO
- f. UV bank on (each bank)
- g. UV bank elapsed time
- h. Lead and lag UV bank (each unit)
- i. Lead and lag channel
- j. Channel influent gate open-closed position (each gate)
- k. Channel influent gate in REMOTE (each gate)
- l. Channel influent gate fail (each gate)
- m. Channel effluent gate open-closed position (each gate)
- n. Channel effluent gate in REMOTE (each gate)
- o. Channel effluent gate fail (each gate)
- p. UV intensity (each bank)
- q. UV power (each bank)
- r. Channel level
- s. UV dose in each channel
- t. Plant effluent flow rate (external signal)

5. The UVSS shall provide complete electronic copies of all PLC, OIT database and graphics, I/O, and configuration program data before shipment of the equipment for use in configuring the PICS, and shall provide updated versions of this information during the field commissioning start up and testing including final version before acceptance of the system.

I. Controls.

1. The UVSS PLC will utilize an isolated 4-20 mA flow pacing signal to adjust the power supply to the lamps. The UVSS OIT and the plant SCADA system shall be designed to allow the operator to adjust the flow rate setting manually or to use the automatic flow rate from the existing effluent flow monitoring device. The UV control system shall automatically turn on and off or dim appropriate lamps and automatically turn on and off individual channels in relation to variations in plant flow.
2. The UV system shall be capable of automatically adjusting the output of the lamps in relation to variations in plant flow.
3. The UV system design shall allow the operator an option to operate the UV system in either manual or automatic modes.

J. Alarms.

1. Details of all alarms shall be displayed on the OIT. Alarms shall be categorized as critical, major, and minor.
2. Non-critical alarms shall be displayed to indicate that maintenance attention is required and shall include the following:
 - a. Maximum end of lamp life hours exceeded.
 - b. Individual lamp failure indicated by address system.
 - c. Individual ballast failure indicated by address system.

- d. Low UV intensity factory set to alarm at 45 percent of the intensity after 100 hours burn in of the lamps, adjustable at the OIT.
 3. Lamps and ballasts shall be addressed by bank number and lamp or lamp pair number.
 4. Critical alarms shall be displayed to indicate an alarm condition in which the UV disinfection performance may be jeopardized. Critical alarms shall be defined by the UVSS, however, as a minimum the following shall be included:
 - a. Low UV intensity alarm, based on using a dynamic deviation set point alarm based on USEPA UVDGM .
 - b. Critical Instrument Failure. Failure of a critical instrument or communications link resulting in a control signal being lost. This condition shall initiate a default routine in the PLC control to put all available UV lamps on to ensure that disinfection will be achieved if physically possible. Critical instrument failure should be identified by UVSS. Personnel and plant safety shall be maintained at all times.
 - c. Loss of flow signal.
 - d. Failure to meet minimum UV Dose.
 - e. PLC failure.
 - f. Multiple lamp driver failure indicated by address.
 - g. Multiple lamp failure indicated by address.
 - h. Water level below lamp submergence level.
 - i. UV transmittance below design level.
 - j. High temperature for each bank.
 - k. UV system power failure.
 - l. Any condition that has initiated a UV system shutdown
 5. An alarm history shall be maintained by the UV control system, and at a minimum, the 100 most recent alarms shall be displayed on the OIT when prompted. Mode of operation for UV banks shall be on, automatic, or off. Elapsed time of each bank shall be recorded and displayed on the display screen when prompted.
- K. Data Exchange With Plant Instrumentation and Control System.
 1. The UV control system shall exchange information with the existing PICS over a direct digital EtherNet/IP datalink. The UVSS shall coordinate the UV control system, programming, and installation to provide a system that works with the Plant Control System. The UVSS shall coordinate the data transfer with the Owner by providing a list of available signals, ranges, and addresses of the status and alarm data and attending a coordination meeting via teleconference with the Owner.
 2. In order to confirm that there are no issues with the communication link between the UV PLC and the PICS, the UVSS shall program control logic that sets and resets a heartbeat bit between the control systems. If this logic fails, an alarm shall be generated to alert the operator of a failed communication link with the UV PLC. The UVSS shall coordinate the required logic for this communication heartbeat with the System Supplier and/or Owner.

3. At a minimum, the following information shall be communicated between the UV system PLC and the PICS.

a. Discrete Data Sent To PICS

- 1) UV system in LOCAL-ON
- 2) UV system in LOCAL-OFF
- 3) UV system in REMOTE -AUTO
- 4) UV bank on (each bank)
- 5) Lead and lag UV bank (each unit)
- 6) Lead and lag channel
- 7) Channel influent gate open-closed position (each gate)
- 8) Channel influent gate in REMOTE
- 9) Channel influent gate fail (each gate)
- 10) Channel effluent gate open-closed position (each gate)
- 11) Channel effluent gate in REMOTE
- 12) Channel effluent gate fail (each gate)
- 13) UV system major alarms
- 14) UV system critical alarms
- 15) Failure to meet minimum UV dose (each unit)*
- 16) Water level below UV lamp submergence level (each channel)*
- 17) UV system PLC failure*
- 18) Maximum lamp hours exceeded (each lamp)
- 19) Lamp failure (each lamp)
- 20) Lamp driver failure (each driver)
- 21) UPS Failure Alarm

*The identified alarms are examples of critical alarms to be communicated to the PICS. All alarms in the system shall be available to be communicated to the PICS.

b. Discrete Data Sent From PICS

- 1) Command UV system or bank to REMOTE-ON
- 2) Command UV system or bank to REMOTE-AUTO
- 3) Command UV bank on (each bank)
- 4) Command UV channel gate open/close
- 5) Vendor to provide additional data points required from PICS for remote supervisory control.

c. Analog Data Sent To PICS

- 1) UV bank elapsed time
- 2) UV intensity (each bank)
- 3) UV power (each bank)
- 4) UV dose in each channel

d. Analog Data Sent From PICS

- 1) UV bank power setpoint (each bank)
- 2) RED dose setpoint, mJ/cm²

e. Analog Data Sent From Discrete Instruments

- 1) Influent Flow (existing instrument)

4. In addition to the data exchange noted above, it is anticipated that there will be many other signals of value to the plant operator to be available across the PICS network link. The additional signals shall be as recommended by the UV System Supplier and Engineer and coordinated with the System Integrator during construction.

L. Instrumentation.

1. Instruments for monitoring and control of the UV system shall be provided and shall include UV intensity sensors for each bank, a position switch to monitor position of each bank at the Ballast (Driver) Cabinet of associated UV channel, a transmittance analyzer for measurement of UV transmittance in the common inlet to the UV channels, and electrode conductance level switches for low-low water level for each UV channel.
2. All instrumentation used in the UV disinfection system for control or monitoring shall be individually fused or circuit breaker protected to minimize the effects of any single point of failure. Instrumentation shall be installed in accordance with UVSS's instructions.
3. Intensity Sensor.
 - a. The intensity sensor shall be compliant with either UVDGM, DVGW, or ONORM standards. Each UV bank shall be provided with a UV intensity sensor, mounted in the top third of lamp vertical distance of each UV bank and connected to the UV control system. The UV intensity sensor shall have at least 95 percent sensitivity to only the germicidal portion of the spectrum (253.7 nm). The sensor shall not use a filter or degrade after prolonged exposure to UV light. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and hence spurious false alarms for low intensity. The UV intensity sensor shall be factory calibrated to US National Institute for Standards and Technology. Sensor must be digitally calibrated to ensure calibration accuracy. Sensor will be turned off during low flow operation.
 - b. The sensor shall be digitally calibrated to ensure calibration accuracy. To ensure continuous disinfection, the sensor shall be accessible without shutting down the system, lifting a bank, or removing lamps. Sensors will be designed to provide UV intensity data for dose monitoring and control functions. Dose pacing program may enable use of measured UV intensity along with flow rate and UVT to determine the delivered dose during operation. Sensors will be designed such that reference sensor readings can be taken without interrupting disinfection and without removing UV lamps, banks sleeves.
 - c. An intensity monitor in a UV unit which has been turned off for low flow operation shall also be turned off so as to prevent the alarm from activating on the main control panel. An adjustable time delay (variable from 0-20 minutes) to bypass the alarm on start and warm-up of the lamps and system shall be provided if required to prevent nuisance alarms.

4. On-Line UV Transmittance (UVT) Sensor.
 - a. A new UVT analyzer will be provided based on UVSS standard offering. The unit will need to be capable of being integrated into the control system for the UV system.
5. Electrode/Conductance Relay Level Switches.
 - a. If required by the UVSS, electrodes shall be rigid AISI Type 316 stainless steel solid rod type with a PVC outer sheath or flexible wire suspension type with shielded stainless steel electrode tips, as indicated on the drawings or in the Instrument Device Schedule. PVC spacers shall be provided at 4-foot intervals of electrode length. Electrode holders shall be 4-inch ANSI Class 125 flange type.
 - b. Electrode relays shall be dual-coil or solid-state relay type with single-pole, double-throw output contacts rated not less than 5 amperes at 120 V ac. The relay primary power shall be 120 V ac, 60 Hz, single phase. Intrinsically safe solid-state relays shall be utilized whenever the electrodes are located in a hazardous area.
 - c. Relays shall be mounted in level switch relay cabinets (LCP-101 and LCP-201), which shall transmit the level signal to the UV Master Control Panel. Electrodes and conductance relays shall be manufactured by Endress + Hauser without exception.
6. Bench Photometer.
 - a. The bench photometer shall be a single beam UV photometer with front panel and 100 percent transmittance control adjustment. The range shall be 0-100 percent transmittance with a wavelength accuracy of +0.16 half band width. Accessories shall include two matched quartz cuvettes, 100 percent T standard solution, and cuvette cleaning solution.
 - b. Manufacturer shall be RealTech.

2.8 FABRICATION

A. Fasteners.

1. All anchors, bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel.
2. Refer to General Equipment Stipulations and Anchorage in Concrete and Masonry sections.

B. Surface Preparation.

1. All ferrous metal surfaces, except stainless steel, shall be shop cleaned by sandblasting or equivalent, conforming to the UVSS recommendation. All mill scale, rust, and contaminants shall be removed before shop primer is applied.

C. Shop Painting.

1. All ferrous metal surfaces, except stainless steel, shall be shop painted in accordance with the General Equipment Stipulations. Each UV disinfection system shall be factory prepared, primed, and finish-coated with the UVSS standard protective coating system. Sharp corners of all rolled edges and all cut or sheared edges shall be ground to a radius as required to ensure paint adherence.

D. Stainless Steel Cleaning.

1. All stainless steel shall be cleaned and passivated at the mill in accordance with ASTM A380 before being shipped. Vat dipping, paste, and other electrical/liquid techniques will be acceptable forms of passivation as acceptable to the Engineer. All stainless steel surfaces shall be adequately protected during fabrication, shipping, handling, and installation to prevent contamination by contact with iron or carbon steel objects or surfaces. Blast cleaning of stainless steel will not be acceptable. Any field welds or repairs may be cleaned and passivated using hand powered tools equipped with clean stainless steel brushes and grindery.
2. Alternative techniques during the manufacturing process to prevent contamination of stainless steel may be acceptable to the Engineer provided that the intent of the paragraph above is met. Manufacturer shall submit a certification stating that the alternative techniques will meet the requirements described herein.

2.9 FACTORY TESTS

- A. All components of the UV system shall be factory tested by operating all lamps, monitoring equipment, and controls prior to shipment. The UV intensity monitor shall be calibrated to the UVSS specifications. Defective equipment and controls disclosed by such tests shall be replaced and the equipment package placed in satisfactory operating condition before shipping. The UVSS shall provide written certification following factory testing. This test may be witnessed by the Owner at the expense of the Owner. The factory test report shall be submitted to the Engineer within 15 days after completion of the testing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment shall be installed and operated, or with the guidance of an authorized representative of the UVSS. The UVSS representative shall have 5 years of experience commissioning UV systems of similar design. All equipment installed under this Contract shall be placed into successful operation according to the written instructions of the UVSS or the instructions of the UVSS's field representative.

3.2 FIELD QUALITY CONTROL

A. Installation Check.

1. An experienced, competent, and authorized representative of the UVSS shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the UVSS's representative shall be present when the equipment is placed in operation in accordance with the Commissioning section and as specified herein, and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.
2. The UVSSs field representative shall furnish a written report certifying that the equipment has been properly installed, is level and in accurate alignment, and has been operated satisfactorily both in manual and automatic modes.
3. All costs for these services shall be included by the UVSS.
4. Pre-Commissioning. The Installation Contractor will coordinate commissioning with the UVSS and Engineer. The UVSS shall include costs in Balance of Work for supporting Installation Contractor. A commissioning plan will be submitted to the Engineer one month before commissioning begins, and shall include, but not be limited to:
 - a. Initial Start Up Activities
 - b. Verification of tags
 - c. Verification of connections
 - d. Instrumentation and control system checks
 - e. Verification of UV control system communication with PICS
 - f. Verification of communication to Ballast (Driver) Cabinets and cleaning system
 - g. Verification of OIT operation
5. Commissioning.
 - a. Commissioning shall include, but not be limited to:
 - 1) Testing electrical connections
 - 2) Testing control signal connections to the UVSS control panel
 - 3) Testing level controls
 - 4) Testing and calibration of instruments including:
 - a) Level switches
 - b) UV transmittance analyzers
 - c) UV intensity transmitters
 - 5) Manual and automatic reactor/bank operation
 - 6) Start up sequence
 - 7) Normal and emergency mode shut down sequence
 - 8) Testing of process, equipment protective, and safety interlocks
 - b. The UVSS's field representative shall startup and operate all UVSS systems in coordination with the Installation Contractor's overall startup plan and under the direction of the Installation Contractor's Startup Manager. The UVSS shall

furnish materials, instruments, and incidental and expendable equipment required for commissioning the equipment.

6. Engineer's Discretionary Testing and Evaluation.
 - a. The Engineer will direct that discretionary tests be performed to determine if the equipment is operating properly. The Engineer may require the Installation Contractor initiate alarm conditions to determine if the control system is functioning properly. UVSS shall support as necessary.
 - b. The Engineer will identify any equipment that has not been properly installed and malfunctions which will require rectification before performance testing.

B. Installation Supervision.

1. The UVSS shall furnish a qualified field installation supervisor during the equipment installation.
2. The UVSS is responsible for the execution services and shall include a minimum of 5 days and 2 trips to the site for Installation Supervision.
3. Startup and field services will only be scheduled upon written request and in coordination with the Installation Contractor's overall startup plan. Installation Contractor shall notify UVSS of schedule requirements at least 10 working days in advance. Upon arrival to commission the equipment, if the UVSS field representative determines the Installation Contractor work is not complete and the start-up cannot be completed in the allotted time, a return visit will be scheduled at the Installation Contractor's expense.
4. UVSS's field representative will observe, instruct, guide, and direct the Installation Contractor's erection or installation procedures. Supervision shall include overseeing the installation the UV lamps by the Installation Contractor.
5. The Installation Contractor shall provide the UVSS with written notification 10 days prior to the need for such services.

3.3 FIELD PERFORMANCE TESTING

- A. Prior to equipment acceptance, performance tests shall be conducted on each UV reactor/bank to demonstrate the equipment meets requirements specified in this Section. The tests shall be conducted after the equipment installation has been approved by the UVSS and the UV lamps have been operated for at least a 100 hour burn-in period. The UV banks shall be manually operated as needed before testing to meet this requirement.
- B. Performance tests shall be conducted based on conditions for flow, UV transmittance, and dose as specified, and considering degradation such as equipment aging and wear, fouling, and cleaning efficiency.
- C. Performance test scheduling shall be coordinated with the Owner and Engineer in coordination with the Installation Contractor's Startup Manager.

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- D. Performance testing of the UV disinfection units shall be successfully completed and written test results accepted by the Engineer before the date of Substantial Completion of the construction contract.
- E. Performance testing shall be at the expense of the UVSS.
- F. The Owner will provide the wastewater effluent to the UV system during start up and testing. All reasonable efforts will be made by the Owner to approximate the specified flow conditions at a steady state for the duration required to allow samples to be taken.
- G. The performance tests shall be under the direct supervision of the UVSS's field representative. Installation Contactor shall supply personnel and equipment necessary to conduct the performance test.
- H. The UVSS's field representative shall prepare a report on the test results. Five copies of the report shall be submitted to the Engineer within 15 days of testing. The information collected will be used as a basis for determining UV system acceptance.
- I. Field Testing.
 - 1. Each channel shall be tested separately. Testing shall be at the design dose at conditions to simulate reduced power simulating end of lamp life UV output. Testing performed with the UV dose in excess of 10 percent of the design UV dose will require re-testing at the UVSS expense.
 - 2. The lamps shall be cleaned as recommended by the UVSS for the duration of the test. Manual cleaning will not be allowed during the performance testing period.
 - 3. UV channels shall be tested at the peak and average daily flow rates. Testing shall be as follows:
 - a. Each channel shall be tested individually at the design flow rate and at the average daily flow.
 - 4. Adjustment shall be made to power output of lamps for variations in transmittance so that the design dose is delivered during the test. Test durations at each flow rate shall be approximately 2 hours. Samples shall be collected every 30 minutes at the influent and effluent of the system tested, with the first sample taken after the system warm up period. The microbial results for all samples collected from the tests on all UV channels, will serve as the basis for determination of acceptance of the equipment. All test results shall be less than performance requirements described in Open Channel Ultraviolet Disinfection System section.
 - 5. Owner reserves the right to conduct additional sampling and testing at any time at Owner's expense without providing advance notification to the UVSS.
 - 6. Data for each sample shall include, but not limited to the following:
 - a. The flow and detention time through the UV disinfection unit at the time of sampling. Detention time shall be calculated from flow and volume of the UV channel minus the volume occupied by the submerged UV equipment.

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- b. Headloss through the UV system.
 - c. The number of UV lamps in operation at the time of testing.
 - d. The measured UV dose in $\text{mW}\cdot\text{sec}/\text{cm}^2$.
 - e. The microbial count per 100 mL in the UV system influent and effluent.
 - f. The total suspended solids concentration in the UV system influent.
 - g. The percent transmittance at a wavelength of 254 nm in the UV system effluent.
 - h. The UV lamp intensity measured by on line instrumentation in $\mu\text{W}\cdot\text{cm}^2$ at a distance of 1 centimeter and as a percentage of UV intensity range.
 - i. Water surface elevations in each channel upstream and downstream of the reactor.
7. Additional data shall be obtained as necessary to demonstrate compliance with requirements in this Section.
 8. The following data shall be collected on the first UV system influent sample on the first day of testing:
 - a. pH.
 - b. Hardness.
 - c. Calcium.
 - d. Total dissolved solids (TDS).
 - e. Iron.
 - f. Water temperature.
 9. Electrical power consumption shall be measured and recorded continuously during performance testing for verification of the power consumption of the UV system. Power will be measured at each bank in each channel. Power consumption shall be measured by a temporary recording watt meter or data logging system. Plot of system power consumption (kWh operating and kW demand) versus flow rate (mgd) during the previous 24-hour period shall be prepared by the UVSS.
 10. Data recorded shall be provided to the Engineer in a Microsoft Excel spreadsheet in hard copy.

J. Sample Collection and Analysis.

1. Sample collection and analysis shall be by an independent, state-certified, Owner-approved testing laboratory. Costs for the testing laboratory shall be included in the UVSS Balance of Work costs. Sample collection, handling, and analysis shall be in accordance with the procedures described in the latest edition of "Standard Methods for the Examination of Water and Wastewater" and 40 CFR Part 136 procedures for effluent testing. In any event, the temperature of samples shall be held below 4°C during a maximum transport time of 2 hours. Samples shall be refrigerated upon receipt in the laboratory and processed within 2 hours.
2. The Engineer and Owner will review the performance test report and will notify the UVSS in writing of UV system acceptance.

3. If after the second, and any subsequent retests allowed, the equipment does not meet the performance requirements, the Owner will select one of the following courses of action:
 - a. Allow the UVSS to make additional modifications and retesting.
 - b. Accept the UV equipment without conditions and issue a written notice that the UV equipment is acceptable.
 - c. Reject the equipment and require the UVSS to remove all equipment from the site, with the UVSS refunding all payments received and compensating Owner for cost of a replacement system.

3.4 TRAINING

- A. An experienced, competent, and authorized representative of the UVSS shall train the Owner's personnel in operating, maintaining, and repairing the equipment specified in this Section. All training shall be conducted at the Owner's location. Training shall commence as mutually agreed to by the Owner, Engineer, Installation Contractor, and UVSS. The scheduled hours for training shall be coordinated with the Owner. The UVSS shall maintain a record of the individuals that have completed training and provide information required for the documentation of Professional Development Hours required by the Owner.
- B. Training sessions may be videotaped by the Owner at the Owner's expense.
- C. The UVSS shall provide required materials, texts, handouts, and supplies. Training material shall be provided to the Owner in written and electronic format. Training materials shall be submitted for review with the O&M manuals. Contractor to coordinate with Section 01 29 00 also.
- D. The UVSS shall provide a combination of classroom and hands-on training. The following training shall be provided.

| Type of Training | Number of Shifts | Number of Participants | Classroom Training (Hours) | Hands-On Training (Hours) |
|--|------------------|------------------------|----------------------------|---------------------------|
| UV Disinfection System | 2 | 16 | 2 | 4 |
| Mechanical Equipment | 2 | 16 | 2 | 4 |
| Electrical, Instrumentation, and Control Equipment | 1 | 4 | 2 | 2 |

- E. Hands-on training shall reinforce classroom training through a demonstration of equipment operation and maintenance procedures. There will be a minimum of 2 training visits, for 3 days each.

Open Channel UV Disinfection System

- F. Types of training specified above shall include the following:
1. UV Disinfection System
 - a. UV disinfection theory
 - b. UV disinfection system overview
 - c. UV disinfection reactors, banks, and lamps
 - d. UV disinfection processes (start up, shut down, flow and dose pacing)
 - e. Maintenance
 2. Mechanical Equipment Training
 3. Electrical, Instrumentation, Control System
 - a. Electrical equipment operation and maintenance
 - b. Control system equipment
 - c. OIT operation
 - d. Instrumentation calibration and maintenance

End of Section

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**APPENDIX 1: TROJAN TECHNOLOGIES FEE PROPOSAL, BID FORM AND SUBMITTAL
(SUBMITTAL TO BE PROVIDED VIA ADDENDUM)**

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Fee Proposal - Bid forms



SECTION 00 41 63 - BID FORM – PRESELECTION

IDENTIFICATION OF GOODS AND SPECIAL SERVICES:

1. Early Work shall consist of the Bidder’s cost for developing an equipment shop drawing submittal per the preselection documents; addressing Engineer’s comments on the shop drawing; and providing a final approved shop drawing submittal.
2. Balance of Work shall consist of all costs for providing goods and services described in the Bidding Documents, other than work identified as Early Work, including, but not limited to the following:
 - a. - Furnish Gates as outlined in the Open-Channel Metal Slide Gates and Weir Gates Section.
 - b. - ETC for other Div 40/46 sections
 - c. - Delivery of Equipment to Site
 - d. - Installation and startup assistance
 - e. - Training
 - f. - Equipment Warranty

Costs for Balance of Work will be the basis for an Allowance in a subsequent general construction contract. The successful general contractor (GC) will subcontract directly with the successful UV Bidder for the Balance of Work scope as part of that general contract.

ARTICLE 1 – BID RECIPIENT

1.01. This Bid is submitted to:

City of Ann Arbor
c/o Customer Service
301 East Huron Street
Ann Arbor, MI 48104

1.02. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with City in the form included in the Bidding Documents to furnish all Goods and Special Services as specified or indicated in the Bidding Documents as Early Work. The Bidder also agrees to guarantee the price for the Balance of the Work that shall be used for a General Contractor to use in a subsequent construction contract.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01. Bidder accepts all of the terms and conditions of the Invitation to Bid and the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for

Bid Form Preselection

60 days after the day of Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of City. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Bidding Documents to City within 15 days after the date of City's Notice of Award.

2.02. Bidder accepts the provisions of the Agreement as to liquidated damages in the event of its failure to furnish the Goods and Special Services in accordance with the schedule set forth in the Agreement.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01. In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents and the following Addenda, receipt of which is hereby acknowledged.

| | <u>Addendum No.</u> | | <u>Addendum Date</u> |
|-----|----------------------|-------|------------------------------|
| No. | Addendum #1 _____ | Dated | February 17th, 2023 _____ |
| No. | Addendum #2 _____ | Dated | March 1, 2023 _____ |
| No. | _____ _____ | Dated | _____ _____ |
| No. | _____ _____ | Dated | _____ _____ |
| No. | _____ _____ | Dated | _____ _____ |

B. If specified, or if in Bidder’s judgment, any local condition may affect cost, progress, or the furnishing of Goods and Special Services, Bidder has visited the Point of Destination and become familiar with and is satisfied as to the local conditions that may affect cost, progress, or the furnishing of Goods and Special Services.

C. Bidder is familiar with and is satisfied as to all Federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Goods and Special Services.

D. Bidder has carefully studied and correlated the information known to Bidder, and information and observations obtained from Bidder’s visits, if any, to the Point of Destination with the Bidding Documents

E. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

F. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Goods and Special Services for which this Bid is submitted.

Bid Form Preselection

3.02. Bidder further represents that this Bid is genuine and is not made in the Interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 3.02:

“corrupt practice” means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

“fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

“collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

“coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 4 – BASIS OF BID

4.01. Bidder will furnish the Goods and Special Services in accordance with the Contract Documents for the following price(s):

Bid Form Preselection

Early Work Lump Sum Bid:

Base Bid, Early (up to \$70,000) \$ 70,000

Balance of Work Lump Sum Bids:

Base Bid, Balance \$ 915,720

Alternate A – Extend standard 12 month warranty to 36 months (add) \$ 52,000

Alternate B - Extend standard 12 month warranty bond to 36 months (add) \$ 5,500

Alternate C – Replace NEMA 12 enclosures with NEMA 4X (add) Spec calls for 316 SS Nema 4X for all Panels, so no adder, but 20K deduct for Control panel to be forced air type 12 mild painted steel \$

Alternate D – Provide redundant UV bank in each channel, including all ancillary equipment, cables, etc. (add) \$ 256,109

ARTICLE 5 – TIME OF COMPLETION

5.01 Bidder agrees that the furnishing of Goods and Services will be completed and ready for final payment in accordance with the schedule defined in SECTION I, PARAGRAPH O of the Request for Proposal as part of the Early Works scope.

ARTICLE 6 - ATTACHMENTS TO THIS BID

6.01. The following documents are attached to and made a condition of this Bid:

- A. Required Bid security.
B. Bidder shall complete Appendix A of the Bid Form for input parameters into the lifecycle evaluation.

ARTICLE 7 – DEFINED TERMS

7.01. Any questions regarding the definition of the terms used in this Bid shall be submitted to the City for clarification. Any misinterpretation of a bid term shall be at the cost of the Bidder.

Bid Form Preselection

ARTICLE 8 – BID SUBMITTAL

8.01. This Bid is submitted by:

By Trojan Technologies Group ULC
(corporation name)

By Rob Jansen - rjansen@trojantechnologies.com
Regional Sales Manager
(title)

Business address 3020 Gore Road, London, ON N5V 4T7

Phone No. 519 - 851 - 2253

Date March 13, 2023

End of Section

Section 00 41 63

ATTACHMENT A – LIFECYCLE EVALUATION INPUTS

A.1 BASE BID BREAKDOWN

| | | |
|---|-----------|-------|
| Spare parts, per specifications | \$ 42,620 | ----- |
| Services of manufacturer representative, per specifications | \$ 44,000 | ----- |
| Owner training, per specifications | \$ 3,000 | ----- |
| Testing, per specifications | \$ 4,500 | ----- |

A.2 POWER CONSUMPTION

Provide required power to operate the complete disinfection system supplied by the UVSS, which may include air compressor, hydraulic system, air conditioning, cooling fan, etc.

| | | | |
|---|------------------------------|-------|----|
| Power at peak flow of 54.0 mgd | 151.6 | ----- | kW |
| Number of lamps “on” at peak flow and lamp percent turndown | 144 at 100% | ----- | |
| Power at average flow of 25.0 mgd | 60.2 | ----- | kW |
| Number of lamps “on” at peak flow and lamp percent turndown | 72 and 78% power at AVG flow | ----- | |

A.3 SYSTEM CONFIGURATION

Provide the following requested information.

| | | |
|------------------------------------|-------------|-------|
| Total Number of Channels | 2 | ----- |
| Total Number of Banks per Channel | 3 | ----- |
| Total Number of Modules per Bank | N/A | ----- |
| Total Number of Modules | N/A | ----- |
| Total Number of Lamps per Module | 24 per bank | ----- |
| Total Number of Lamps | 144 | ----- |
| Total Number of Ballast or Drivers | 72 | ----- |

Bid Form Preselection

Confirm a dimensioned figure showing the proposed UV system was provided for estimating structural requirements of the system. Figure should show length, width, and depth of proposed channels and required areas for maintenance activities. Additionally, the proposed fixed weirs shall be shown as well and required weir length.

Confirmed, please see drawings section

A.4 REPLACEMENT COSTS

Provide guaranteed replacement parts costs for the following.

| Component | Individual Replacement Cost (\$/unit) | Lot Replacement Cost (\$/lot) | Quantity per Lot |
|----------------|---------------------------------------|-------------------------------|------------------|
| Lamp | 550 | \$13,200/bank | 24 |
| Ballast/Driver | 700 | \$8400/bank | 12 |
| Quartz Sleeve | 150 | \$3600/bank | 24 |
| Wiper | 10 | \$480/bank | 48 |

Provide other acceptable replacement parts suppliers/manufacturers of spare parts.

UV Lamp I assume there are others that will supply, but we cannot guarantee performance

Ballast/Driver I assume there are others that will supply, but we cannot guarantee performance

Wiper I assume there are others that will supply, but we cannot guarantee performance

A.5 EXPECTED PART LIFE

Lamp (hours) 18,000 - 20,000

Ballast/Driver (hours) 87,600 - 100,000

Wiper (wipes) 3000

Recommended wipes per day 4

Quartz Sleeves (years) 10

Bid Form Preselection

A.6 CHEMICAL CLEANING

Provide estimated annual chemical consumption for cleaning the system based on average flow conditions.

| | |
|--------------------------------------|------------------------------------|
| Chemical consumption (gallons/month) | 1.3 gallons/month/channel ----- |
| Chemical Cost (\$/gallon) | \$40/gal ----- |
| Chemical Product Name | Acticlean Gel ----- |

A.7 HYDRAULICS

Provide headloss through UV system. As appropriate, clarify the number of channels that are operational for each scenario

| | |
|--|--|
| Headloss through UV modules at peak flow | 5.2 ----- inches |
| | 2 ----- channels in operation |
| Headloss through UV modules at average flow | 1.4 ----- inches |
| | 1 ----- channels in operation |
| Maximum water level fluctuation through system | 7.32 ----- inches |
| | (Of note, system is capable of up to 12" without flooding banks) |

A.8 EQUIPMENT DELIVERY

The preselection of a UVSS will allow an approved shop drawing to be developed during design. The approved shop drawings will be provided to the apparent low bidder during general bidding. Provided this information, the equipment shall be delivered Freight on Board (FOB) job site _____ 30 _____ weeks after a general contractor is issued a notice to proceed.

(Note Actuators we were told will be 34-35 weeks)

A.9 UV DOSE DURING EQUIPMENT OUTAGE

Calculate the maximum UV dose to be delivered at the peak flow condition and other defined design criteria from Section 46 66 56 with one UV module in each channel out of service.

| | |
|--|--------------------------------|
| Dose at peak flow of 54.0 mgd | 20.7 ----- mJ/cm2 |
| Power at peak flow of 54.0 mgd | 101.1 ----- kW |
| Number of lamps "on" at design condition and lamp percent turndown | 96 lamps at 65% power ----- |

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ATTACHMENT B
GENERAL DECLARATIONS

City of Ann Arbor
Guy C. Larcom Municipal Building
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including City Nondiscrimination requirements and Declaration of Compliance Form, Living Wage requirements and Declaration of Compliance Form, Prevailing Wage requirements and Declaration of Compliance Form, Vendor Conflict of Interest Form, Notice of Pre-Bid Conference, General Information, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans (if applicable) and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered _____, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:320 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting requirements stated in the City Code provisions cited. Bidder certifies that the statements contained in the City Prevailing Wage and Living Wage Declaration of Compliance Forms are true and correct. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS _____ DAY OF _____, 202_.

Bidder's Name

Authorized Signature of Bidder

Official Address

(Print Name of Signer Above)

Telephone Number

Email Address for Award Notice

ATTACHMENT C
LEGAL STATUS OF BIDDER

(The bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

* A corporation organized and doing business under the laws of the State of _____, for whom _____, bearing the office title of _____, whose signature is affixed to this Bid, is authorized to execute contracts.

NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority

• A limited liability company doing business under the laws of the State of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

* A partnership, organized under the laws of the state of _____ and filed in the county of _____, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):

* An individual, whose signature with address, is affixed to this Bid: _____
(initial here)

Authorized Official

_____ **Date** _____, 202_

(Print) Name _____ Title _____

Company:

Address:

Contact Phone () _____ Fax () _____

Email _____

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ATTACHMENT E
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than \$10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than \$10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than \$10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here No. of employees

The Contractor or Grantee agrees:

- (a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as \$15.90/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than \$17.73/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

- Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits
- Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

- (b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.
- (c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.
- (d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.
- (e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

Company Name

Street Address

Signature of Authorized Representative

Date

City, State, Zip

Print Name and Title

Phone/Email address

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Attachment F

CITY OF ANN ARBOR LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2023 - ENDING APRIL 29, 2024

\$15.90 per hour

If the employer provides health care benefits*

\$17.73 per hour

If the employer does **NOT** provide health care benefits*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than \$10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

V.

W. ENFORCEMENT

X. The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than \$500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed \$.50 an hour for an average work week; and the employer cost or contribution must equal no less than \$1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

**For Additional Information or to File a Complaint contact
Colin Spencer at 734/794-6500 or cspencer@a2gov.org**

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ATTACHEMENT G

| |
|--|
| Vendor Conflict of Interest Disclosure Form |
|--|

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

| Conflict of Interest Disclosure* | |
|---|---|
| Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest. | <input type="checkbox"/> Relationship to employee <hr/> <input type="checkbox"/> Interest in vendor's company <input type="checkbox"/> Other (please describe in box below) |
| | |

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

| I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below: | | |
|---|---------------------|--|
| | | |
| Vendor Name | Vendor Phone Number | |
| | | |
| Signature of Vendor Authorized Representative | Date | Printed Name of Vendor Authorized Representative |

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ATTACHMENT I

CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the Ann Arbor City Code are included below.
You can review the entire ordinance at www.a2gov.org/humanrights.

Intent: It is the intent of the city that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

Discriminatory Employment Practices: No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in any labor union or apprenticeship program.

Discriminatory Effects: No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employment or public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

Nondiscrimination by City Contractors: All contractors proposing to do business with the City of Ann Arbor shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All city contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at all work locations where its employees provide services under a contract with the city.

Complaint Procedure: If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed within this timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at www.a2gov.org/humanrights. Then submit it to the Human Rights Commission by e-mail (hrc@a2gov.org), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor, MI 48107), or in person (City Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at hrc@a2gov.org.

Private Actions For Damages or Injunctive Relief: To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damages or both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

MICHIGAN DEPARTMENT OF TRANSPORTATION CERTIFIED PAYROLL

COMPLETION OF CERTIFIED PAYROLL FORM FULFILLS THE MINIMUM MDOT PREVAILING WAGE REQUIREMENTS

(1) NAME OF CONTRACTOR / SUBCONTRACTOR (CIRCLE ONE) (2) ADDRESS

(3) PAYROLL NO. (4) FOR WEEK ENDING (5) PROJECT AND LOCATION (6) CONTRACT ID

| (a) EMPLOYEE INFORMATION | (b) WORK CLASSIFICATION | (c) Hour Type | (d) DAY AND DATE | | | | | | | (e) TOTAL HOURS ON PROJECT | (f) PROJECT RATE OF PAY | (g) PROJECT RATE OF FRINGE PAY | (h) GROSS PROJECT EARNED GROSS WEEKLY EARNED | (i) TOTAL WEEKLY HOURS WORKED ALL JOBS | (j) DEDUCTIONS | | | | | (k) TOTAL WEEKLY WAGES PAID FOR ALL JOBS |
|-----------------------------|----------------------------|------------------|------------------|--|--|--|--|--|---|-------------------------------|----------------------------|-----------------------------------|--|---|----------------|---------|-------|-------|--------------|---|
| | | | | | | | | | | | | | | | FICA | FEDERAL | STATE | OTHER | TOTAL DEDUCT | |
| NAME: | | | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |
| ETH/GEN: ID #: NAME: | GROUP/CLASS #: | S | | | | | | | 0 | | | \$0.00 | | | | | | | \$0.00 | \$0.00 |

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ATTACHMENT J
PREVAILING WAGE RATE DETERMINATION

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"General Decision Number: MI20230100 09/08/2023

Superseded General Decision Number: MI20220100

State: Michigan

Construction Type: Building

County: Washtenaw County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

| | |
|--|--|
| <p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p> | <p>. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.</p> |
| <p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p> | <p>. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.</p> |

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

| Modification Number | Publication Date |
|---------------------|------------------|
| 0 | 01/06/2023 |
| 1 | 02/03/2023 |

- 2 04/07/2023
- 3 07/21/2023
- 4 09/01/2023
- 5 09/08/2023

ASBE0025-003 06/01/2021

Townships of Ann Arbor, Augusta, Lodi, Northfield, Pittsfield, Salem, Saline, Scio, Superior, Webster, Ypsilanti & York

| | Rates | Fringes |
|---|----------|---------|
| ASBESTOS WORKER/HEAT & FROST INSULATOR..... | \$ 35.41 | 32.91 |

* ASBE0047-001 07/01/2023

Townships of Bridgewater, Dexter, Freedom, Lims, Lyndon, Manchester, Sharon & Sylvan

| | Rates | Fringes |
|---|----------|---------|
| ASBESTOS WORKER/HEAT & FROST INSULATOR..... | \$ 36.62 | 19.78 |

BOIL0169-001 01/01/2021

| | Rates | Fringes |
|------------------|----------|---------|
| BOILERMAKER..... | \$ 35.95 | 34.52 |

BRMI0009-010 08/01/2022

| | Rates | Fringes |
|--------------------|----------|---------|
| BRICKLAYER..... | \$ 38.38 | 25.26 |
| TILE FINISHER..... | \$ 28.58 | 21.34 |
| TILE SETTER..... | \$ 35.71 | 21.34 |

CARP0687-001 06/01/2021

| | Rates | Fringes |
|--|----------|---------|
| CARPENTER, Includes Drywall Hanging, Form Work, and Metal Stud Installation..... | \$ 35.16 | 29.22 |

CARP1045-001 06/01/2020

| | Rates | Fringes |
|--|----------|---------|
| CARPENTER (Floor Layer - Carpet, Resilient, & Vinyl Flooring)..... | \$ 30.60 | 24.58 |

CARP1102-002 06/01/2020

| | Rates | Fringes |
|-----------------|----------|---------|
| MILLWRIGHT..... | \$ 35.30 | 34.10 |

ELEC0252-010 06/01/2021

| | Rates | Fringes |
|------------------|----------|-----------|
| ELECTRICIAN..... | \$ 47.46 | 27%+12.25 |

ENGI0324-017 06/01/2023

| | Rates | Fringes |
|---------------------------|----------|---------|
| OPERATOR: Power Equipment | | |
| GROUP 1..... | \$ 47.49 | 25.35 |
| GROUP 2..... | \$ 46.29 | 25.35 |
| GROUP 3..... | \$ 44.79 | 25.35 |
| GROUP 4..... | \$ 44.49 | 25.35 |
| GROUP 5..... | \$ 43.67 | 25.35 |
| GROUP 6..... | \$ 42.81 | 25.35 |
| GROUP 7..... | \$ 41.84 | 25.35 |
| GROUP 8..... | \$ 40.13 | 25.35 |
| GROUP 9..... | \$ 31.79 | 25.35 |

FOOTNOTES:

Tower cranes: to be paid the crane operator rate determined by the combined length of the mast and the boom. If the worker must climb 50 ft. or more to the work station, \$.25 per hour additional.

Derrick and cranes where the operator must climb 50 ft. or more to the work station, \$.25 per hour additional to the applicable crane operator rate.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane with boom and jib or leads 400' or longer

GROUP 2: Crane with boom and jib or leads 300' or longer

GROUP 3: Crane with boom and jib or leads 220' or longer

GROUP 4: Crane with boom and jib or leads 140' or longer

GROUP 5: Crane with boom and jib or leads 120' or longer

GROUP 6: Regular crane operator, and concrete pump with boom operator

GROUP 7: Backhoe/Excavator/Trackhoe, bobcat/skid Loader, broom/sweeper, bulldozer, grader/blade, highlift, hoist, loader, roller, scraper, tractor & trencher

GROUP 8: Forklift & extend-a-boom forklift

GROUP 9: Oiler

IRON0025-019 06/01/2022

| | Rates | Fringes |
|------------------|----------|---------|
| IRONWORKER | | |
| REINFORCING..... | \$ 31.43 | 34.77 |
| STRUCTURAL..... | \$ 34.85 | 40.42 |

LAB00334-005 06/01/2023

| | Rates | Fringes |
|--|-------|---------|
|--|-------|---------|

LABORER: Landscape & Irrigation

| | | |
|--------------|----------|------|
| GROUP 1..... | \$ 23.75 | 9.10 |
| GROUP 2..... | \$ 21.75 | 9.10 |

CLASSIFICATIONS

GROUP 1: Landscape specialist, including air, gas and diesel equipment operator, lawn sprinkler installer, skidsteer (or equivalent)

GROUP 2: Landscape laborer: small power tool operator, material mover, truck driver and lawn sprinkler installer tender

LAB00499-005 08/01/2022

| | Rates | Fringes |
|---|----------|---------|
| LABORER | | |
| Common or General; Grade Checker; Sandblaster..... | \$ 30.66 | 14.70 |
| Mason Tender - Brick; Mason Tender - Cement/Concrete..... | \$ 31.21 | 14.70 |
| Pipelayer..... | \$ 31.02 | 14.70 |

PAIN0022-003 06/01/2022

| | Rates | Fringes |
|--|----------|---------|
| PAINTER: Brush and Roller..... | \$ 32.85 | 20.41 |
| PAINTER: Drywall Finishing/Taping..... | \$ 32.85 | 20.41 |
| PAINTER: Spray..... | \$ 26.86 | 17.66 |

PAIN0357-002 06/01/2023

| | Rates | Fringes |
|--------------|----------|---------|
| GLAZIER..... | \$ 38.66 | 20.98 |

PAID HOLIDAYS: New Year's Day, Decoration Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day; provided that the employee has worked the last full regular scheduled work day prior to the holiday, and the first full regular scheduled work day following the holiday, provided the employee is physically able to work.

PLAS0514-006 06/01/2018

| | Rates | Fringes |
|-----------------------------------|----------|---------|
| CEMENT MASON/CONCRETE FINISHER... | \$ 31.47 | 13.81 |

PLUM0190-004 06/01/2023

| | Rates | Fringes |
|--|----------|---------|
| PIPEFITTER (Including HVAC Pipe Installation; Excluding HVAC System Installation)..... | \$ 46.88 | 23.70 |
| PLUMBER, Excludes HVAC Pipe | | |

and Unit Installation.....\$ 44.31 23.70

ROOF0070-001 05/08/2023

Rates Fringes

ROOFER.....\$ 39.67 18.85

SFMI0704-001 08/01/2023

Rates Fringes

SPRINKLER FITTER (Fire Sprinklers).....\$ 49.72 32.00

SHEE0080-001 06/01/2022

Rates Fringes

SHEET METAL WORKER, Includes HVAC Duct and Unit Installation.....\$ 47.64 26.15

TEAM0247-001 06/01/2023

Rates Fringes

TRUCK DRIVER

GROUP 1

Flatbed; Pickup; Dump & Tandem.....\$ 29.82 0.70+a+b

GROUP 2

Semi.....\$ 29.97 0.70+a+b

GROUP 3

Lowboy.....\$ 30.07 0.70+a+b

PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If any of the above holidays fall on a Sunday, the following Monday shall be considered the holiday and, if work is performed, the rate shall be double time.

FOOTNOTE:

a. \$456.70 per week, plus \$67.10 per day.

* SUMI2011-025 02/01/2011

Rates Fringes

IRONWORKER, ORNAMENTAL.....\$ 18.48 7.93

TRUCK DRIVER: Tractor Haul

Truck.....\$ 13.57 ** 1.18

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$16.20) or 13658 (\$12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all

rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"