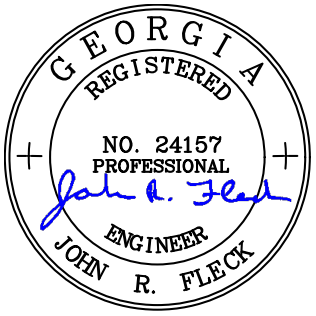
CONTRACT DOCUMENTS
FOR

Rockdale County, Georgia

Gees Mill Water Treatment Plant
Ozone Generator Replacement

March 2025



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TECHNICAL SPECIFICATIONS

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SECTION 00 11 00
SUMMARY OF WORK

1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The work to be performed under this Contract consists of furnishing all labor, materials, tools, equipment, and incidentals and performing all work required to construct complete in place and ready to operate the replacement of the ozone generator at the Gees Mill Water Treatment Plant.

B. In general, the Gees Mill WTP Ozone Generator Replacement project will consist of the following major work:

1. Removal of the existing ozone generator.
2. Modifications to the existing chilled water piping, oxygen supply piping, and ozone feed piping.
3. Installation of the new ozone generator and accessories.
4. Modifications to the electrical and control system.
5. Replacement of media in existing ozone destruct units.
6. Modifications to ozone piping at the ozone contact basins.

1.2 PROJECT LOCATION

A. The project site is located at 3090 Gees Mill Road, Conyers, GA 30013.

1.3 COORDINATION

A. The Gees Mill WTP is a functioning water treatment plant and must be kept in operation at all times. Shut down of any equipment, treatment process, power supply, etc. must be coordinated with the Owner. Contractor shall not turn on or off any equipment or turn on or off power to any equipment unless specifically authorized by the Owner. Owner's personnel must be present when any equipment is turned on or off.

B. Prior to removal of the existing ozone generator, Contractor shall coordinate with plant operations personnel to ensure isolation of the generator from the system and there will be no impact to the operation of the remaining in-service ozone generator.

** END OF SECTION **

SECTION 01 21 00
ALLOWANCES

1 GENERAL

1.1 DESCRIPTION

A. The Contractor shall include in his proposal the allowance amount(s) listed below.

B. Contractor shall refer to the Proposals from each Supplier, included in these documents, regarding scope to be supplied and/or installed under each sole-source equipment allowance. Contractor shall be responsible for compliance with all requirements of the Contract Documents for all equipment and services provided under said allowance.

C. The allowance(s) shall cover work, manufactured equipment or services that will be provided either by the Contractor or by others who may be selected by the Owner. All work performed under allowance(s) will be eligible for payment only with the Owner's prior written approval, and under special terms described herein.

D. Subcontract Allowances: Authorized subcontract work that is performed by subcontractors to the General Contractor and paid for under Allowances is considered to be subcontract work to the Contractor. Therefore, in accordance with the General Conditions of the Contract, actual payment to the Contractor will be actual cost of the subcontractor's charges plus a fee equal to five percent (5%) of subcontractor's charges.

E. Cash Allowances for Purchases and Purchased Services: Where Contractor purchases equipment or materials that are authorized to be paid from Allowances and installed or incorporated into the project, the Contractor's costs for unloading, handling, installation, overhead, profit, taxes, and other expenses are to be included in Contractor's Bid Price. This same provision will apply to Purchased Services by Owner from parties who are not a subcontractor to the Contractor.

F. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Contractor's handling costs on the site, labor, installation costs, overhead, profit, taxes, and other expenses contemplated for the original allowance shall be included in the Contract Sum and not in the allowance. The Contractor shall cause work covered by these allowances to be performed for such amounts and by such persons as the Owner/Engineer may direct, but he will not be required to employ persons against whom he makes a reasonable objection. If the cost, when determined, is more than or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order.

2 SCHEDULE OF ALLOWANCES

2.1 CASH ALLOWANCES

A. The Contractor's Total Base Bid shall include an allowance of $865,000.00 to cover the purchase price of the materials and labor for the new Ozone Generator and manufacturer services as described in Primozone proposal dated March 14, 2025 (Appendix A). This cost does not include federal, state, or local taxes. Taxes, if applicable, and any other costs required to complete the work shall be included in the Contractor's Lump Sum Bid price.

B. The Contractor's Total Base Bid shall include an allowance of $25,000.00 to cover the purchase price of the materials and labor for the replacement of ferrous metals within the chilled water system circulation piping including pumps, fitting, valves, and piping. This cost shall also cover federal, state, and local taxes. This cost does not include the labor, materials, and equipment necessary to inspect the chiller system to identify any ferrous metals within the chilled water circulation system, which shall be included in the Contractor's Lump Sum Bid price.

** END OF SECTION **

SECTION 01 22 00
MEASUREMENT AND PAYMENT

1 GENERAL

1.1 SUMMARY

A. Scope

1. The Bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid.
2. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.
3. Work includes furnishing all plant, labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the Work satisfactorily, in place, as specified and as indicated on the Drawings.
4. The Contractor shall take no advantage of any apparent error or omission on the Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.
5. Where the Specifications and/or Contract Drawings are silent on Payment for work specified under an individual Specification Section or on the Drawings, it is understood that Payment will be made as part of the Lump Sum price bid.

1.2 DESCRIPTIONS

A. Measurement of an item of work will be by the unit indicated in the Bid.

1. Payment of the lump sum items established in the Contractor's Bid shall be full compensation for all labor, materials, and equipment required to furnish, install, construct, and test the Work covered under the lump sum proposal item. Payment of the lump sum items established in the Contractor's Bid shall also fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the Work.

B. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the Bid.

C. Unless otherwise stated in individual sections of the Specifications or in the Bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.

D. The lump sum items shall be specifically subdivided by activity/CSI format, broken-out in the Schedule of Values. Each schedule of value's description of work shall contain a unique identifier for the purpose of differentiating each schedule of value. Payments for the lump sum items specifically broken-out in the Schedule of Values will be based upon physical progress for each activity in accordance with the breakdown of the Lump Sum prices agreed to in the Schedule of Values.

1.3 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for the following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.

3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Material and equipment not properly stored.
6. Defective Work not accepted by Owner.
7. Material remaining on hand after completion of Work.

1.4 PARTIAL PAYMENT OF STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings or preliminary operation and maintenance manuals are acceptable to Engineer.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.5 BID ITEMS

A. Bid Prices included on the Bid Form shall be full compensation for all materials, labor, equipment, tools, construction equipment and machinery, heat, utilities, transportation, taxes, overhead, markup, incidentals and services necessary for the execution and completion of the Work in the Contract Documents to be performed under this Contract. For the Work described, the lump sum and allowance, actual used and installed quantities of each bid item shall be measured in the field and certified by the Engineer and/or Owner upon completion of construction in the manner set forth for each item in this and other sections of the Specifications. Payment for all items listed on the Bid Form will constitute full compensation for all Work shown and specified to be performed.

B. The following items 1 through 3 comprise the Base Bid Total as listed on the Bid Form. Owner may elect to select all or some of the bid items for inclusion in the Contract.

1. OZONE GENERATION SYSTEM INSTALLATION

a. MEASUREMENT: Measurement shall be based on the successful completion of the installation and start-up of the Gees Mill WTP Ozone Generator Replacement, as required by the plans and specifications.

b. PAYMENT: The Lump Sum Price bid under this section shall include the furnishing of all labor, materials, and equipment for properly installing the new ozone generator, including but not limited to: demolition of existing facilities, installation of the new ozone generator, modifications to existing oxygen supply, chilled water, and ozone feed piping, electrical system modifications, control system modifications and integration, replacement of 2-inch ball valves and stainless steel piping at ozone contact chambers, piping, fittings, valves, and all other work necessary for a complete and fully functioning system, as specified and shown in the Contract Documents, whether specifically mentioned or implied, except that Work specifically included for payment under any other Bid Item.

2. OZONE DESTRUCT UNIT FILTER MEDIA REPLACEMENT

a. MEASUREMENT: Measurement shall be based on the successful completion of the replacement of the filter media in the existing ozone destruct units located at the ozone contact chambers, as required by the plans and specifications.

b. PAYMENT: The Lump Sum Price bid under this section shall include the furnishing of all labor, materials, and equipment for properly removing and disposing of the existing filter media, and installing the new filter media in the existing ozone destruct units, and all other work necessary for a complete and fully functioning system, as specified and shown in the Contract Documents, whether specifically mentioned or implied, except that Work specifically included for payment under any other Bid Item.

3. CASH ALLOWANCES

a. Ozone Generator

1) MEASUREMENT: An allowance has been established for the value of this item. This allowance may be used, as authorized and directed by the Owner or Engineer, to pay for the costs of ozone generator equipment and manufacturer start-up services as specified in Primozone's proposal included in the contract documents.

2) PAYMENT: The allowance price shown shall cover all costs for the ozone generation equipment and manufacturer services, as invoiced by Primozone. Payments will be made for the invoiced amounts without markup by the Contractor.

b. Chiller System Ferrous Metal Replacement

1) MEASUREMENT: An allowance has been established for the value of this item. This allowance may be used, as authorized and directed by the Owner or Engineer, to pay for the costs of removal and replacement of ferrous metal items within the chilled water circulation system.

2) PAYMENT: The allowance price shown shall cover the costs for materials, labor, and equipment to remove and replace any ferrous containing materials in contact with the chilled water with Type 316 stainless steel materials, including pumps, fitting, valves, and piping.

4. CONTINGENCY ALLOWANCES

a. Unforeseen Work Elements

1) MEASUREMENT: An allowance has been established for the value of this item. The Contractor agrees that this allowance is for the sole use of Owner to cover costs associated with Unforeseen Work Elements. Costs shall be determined as specified in General Conditions Article 29, and as directed by the Engineer.

2) PAYMENT: Payment will be made for work not shown or specified in the Drawings or Specifications and not covered by another item in the Bid Schedule based on an agreed upon costs submitted by the Contractor and approved by the Engineer and Owner in advance of the work.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01 25 00
SUBSTITUTION PROCEDURES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedural requirements for product substitutions.
2. Procedural requirements for substitute construction methods or procedures, when construction methods or procedures are specified.

B. Requests for substitutions of equipment and material shall conform to the requirements of the General Conditions and Supplementary Conditions.

C. Procedure for substitution requests and review including evaluation, reimbursement, acceptance, and determination shall be in accordance with General Conditions and Supplementary Conditions.

1.2 REFERENCES

A. Definitions: The following words or terms are not defined but, when used in this Section, have the following meaning:

1. “Products” includes materials, equipment, machinery, components, fixtures, systems, and other goods incorporated in the Work. Products do not include machinery and equipment used for preparing, fabricating, conveying, erecting, or installing the Work. Products include Owner-furnished goods incorporated in the Work where use of such goods is specifically required in the Contract Documents.

1.3 ADMINSTRATIVE REQUIREMENTS

A. Contractor’s Responsibilities

1. In submitting request for substitution, Contractor represents that:
   a. Contractor has investigated proposed substitution and determined that it is equivalent to item, product, method, or procedure specified, as applicable.
   b. Contractor will provide the same or better guarantees or warranties for proposed substitution as for the specified product, manufacturer, method, or procedure, as applicable.
   c. Contractor waives all Claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.

B. Engineer’s Review

1. A proposed substitution will not be accepted for review if:
   a. Approval would require changes in design concept or a substantial revision of the Contract Documents.
   b. Approval would delay completion of the Work or the work of other contractors.
   c. Substitution request is indicated or implied on a Shop Drawing or other submittal, or on a request for interpretation or clarification, and is not accompanied by Contractor’s formal request for substitution.

C. If Engineer does not approve the proposed substitute, Contractor shall provide the specified product, manufacturer, method, or procedure, as applicable.

D. Approval of a substitution request will not relieve Contractor from requirement for submitting Shop Drawings as set forth in the Contract Documents.

E. Product Substitutions Procedure

1. Requests for approval of substitute products or items will be considered for a period of

30 days after the Effective Date of the Agreement. After end of specified period, requests will be considered only in case of unavailability of a specified product or other conditions beyond Contractor's control.

2. Submit two (2) copies of request for substitution.
3. Submit separate request for each substitution.
4. In addition to requirements of the General Conditions and information required on substitution request forms, include with request the following:
    a. Product identification, including manufacturer's name and address.
    b. Manufacturer's literature with product description, performance and test data, and reference standards with which product complies.
    c. Samples, if appropriate.
    d. Name and address of similar projects on which product was used, and date of installation.
    e. Certified tests, where applicable, by an independent laboratory attesting the proposed substitution is equal.
    f. Cost information for the proposed substitution and the specified products.

F. Construction Methods Substitutions Procedures

1. Where construction methods or procedures are specified, for a period of 30 days after the Effective Date of the Agreement, Engineer will consider Contractor's written requests for substitute construction methods or procedures specified.
2. Submit two (2) copies of request for substitution.
3. Submit separate request for each substitution.
4. In addition to requirements of the General Conditions and information required on substitution request forms, include with request the following:
    a. Detailed description of proposed method or procedure.
    b. Itemized comparison of the proposed substitution with the specified method or procedure.
    c. Drawings illustrating method or procedure.
    d. Other data required by Engineer to establish that proposed substitution is equivalent to specified method or procedure.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General Conditions and Supplementary Conditions provision expansion, including the following:
    a. Requests for Interpretation
    b. Field Orders
    c. Work Change Directives
    d. Proposal Requests
    e. Change Proposals
    f. Change Orders

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submit Contract modification documents to Engineer's contact person and address in the Contract Documents.

B. Retain at Contractor's office and at the Site complete copy of each Contract modification document and related documents, and Engineer's response.

1.3 REQUEST FOR INTERPRETATION

A. General

1. Submit written or electronic requests for interpretation to Engineer. Contractor and Owner may submit requests for interpretation.
2. Submit request for interpretation to obtain clarification or interpretation of the Contract Documents. Report conflicts, errors, ambiguities, and discrepancies in the Contract Documents using requests for interpretation.
3. Do not submit request for interpretation when other form of communication is appropriate, such as submittals, requests for substitutions or "or equals", notices, ordinary correspondence, or other form of communication. Improperly prepared or inappropriate requests for interpretation will be returned without response or action.

B. Procedure

1. Submit one original (hard copy or electronic) of each request for interpretation. Submit each request for interpretation with separate letter of transmittal if hard copies are submitted.
2. Engineer will provide timely review of requests for interpretation. Allow sufficient time for review and response.
3. Engineer will maintain log of requests for interpretation. Copy of log will be provided upon request.
4. Engineer will provide written response to each request for interpretation. One copy of Engineer's response will be distributed to:
    a. Contractor
    b. Owner
    c. Engineer
    d. Resident Project Representative (RPR)

C. If Engineer requests additional information to make an interpretation, provide information

requested within ten (10) days, unless Engineer allows additional time, via correspondence referring to request for interpretation number.

D. If Contractor or Owner believes that a change in the Contract Price or Contract Times or other change to the Contract is required, notify Engineer in writing before proceeding with the Work associated with the request for interpretation.

E. Submit each request for interpretation on a form acceptable to Engineer.

1. Number each request for interpretation as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential number.

2. In space provided on form, describe the interpretation requested. Provide additional sheets as necessary. Include text and sketches as required in sufficient detail for engineer's response.

3. When applicable, request for interpretation shall include Contractor's recommended resolution.

1.4 FIELD ORDERS

A. General

1. Field Orders, when required, will be initiated and issued by Engineer.

2. Field Orders authorize minor variations in the Work but do not change the Contract Price or Contract Times.

3. Field Orders will be in the form of Engineers Joint Contract Documents Committee (EJCDC) document C-942, "Field Order" or other Engineer's accepted form.

4. Engineer will maintain a log of Field Orders issued.

B. Procedure

1. Electronic copies of Field Orders will be maintained, stored, and distributed by Engineer.

2. If Contractor or Owner believes that a change in the Contract Price or the Contract Times or other change to the Contract is required, immediately notify Engineer in writing before proceeding with the Work associated with the Field Order.

3. If the Field Order is unclear, submit request for interpretation.

1.5 WORK CHANGE DIRECTIVE

A. General

1. Work Change Directives, when required, order additions, deletions, or revisions to the Work.

2. Work Change Directives do not change the Contract Price or Contract Times but are evidence that the parties to the Contract expect that the change ordered or documented by the Work Change Directive will be incorporated in subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

B. Work Change Directives will be in the form of EJCDC document C-940, "Work Change Directive" or other Engineer's accepted form.

C. Procedure

1. Three originals of Work Change Directive signed by Owner and Engineer will be furnished to Contractor, who shall promptly sign each original Work Change Directive and, within five days of receipt, return all originals to Engineer.

2. Original, signed Work Change Directives will be distributed as follows:

a. Contractor: One original

b. Owner: One original

c. Engineer: One original

3. One hard copy of each Work Change Directive will be distributed to: Resident Project Representative (RPR).

4. When required by Engineer, document for the Work performed under each separate Work Change Directive, for each day, the number and type of workers employed and hours worked; equipment used including manufacturer, model, and year of equipment, and number of hours; materials used, receipts for and descriptions of materials and equipment incorporated into the Work, invoices and labor and equipment breakdowns for Subcontractors and Suppliers, and other information required by Owner or Engineer, in a format acceptable to Engineer. Submit this documentation to Engineer as a Change Proposal.

1.6 PROPOSAL REQUESTS

A. General

1. Proposal requests may be initiated by Engineer or Owner.

2. Proposal requests are for requesting the effect on the Contract Price and the Contract Times and other information relative to contemplated changes in the Work. Proposal requests do not authorize changes or variations in the Work, and do not change the Contract Price or Contract Times or terms of the Contract.

3. Proposal requests will be furnished using the proposal request form included with this Section.

B. Procedure

1. One copy of each signed proposal request will be furnished to Contractor with one copy each to:

a. Owner

b. Engineer

c. Resident Project Representative (RPR)

2. Submit request for interpretation to clarify conflicts, errors, ambiguities, and discrepancies in proposal request.

3. Upon receipt of proposal request, Contractor shall prepare and submit a Change Proposal, in accordance with this Section, for the proposed Work described in the proposal request.

1.7 CHANGE PROPOSALS

A. General

1. Submit written Change Proposal to Engineer in response to each proposal request, and when Contractor believes a change in the Contract Price or Contract Times or other change to the terms of the Contract is required.

B. Procedure

1. Submit to Engineer one original and one copy of each Change Proposal with accompanying documentation, and simultaneously submit two copies to Owner. Submit each Change Proposal with separate letter of transmittal.

2. Engineer will review Change Proposal and either request additional information from Contractor or provide to Owner recommendation regarding approval of the Change Proposal.

3. When Engineer requests additional information to render a decision, submit required information within five days of receipt of Engineer’s request, unless Engineer allows more time. Submit the required information via correspondence that refers to Change Proposal number.

4. Upon completing review, one copy of Engineer’s written response, if any, will be

distributed to:

a. Contractor

b. Owner

c. Engineer

d. Resident Project Representative (RPR)

5. If Change Proposal is recommended for approval by Engineer and approved by Owner, a Change Order will be issued.

6. If parties do not agree on terms for the change, Owner or Contractor may file a Claim against the other, in accordance with the General Conditions and the Supplementary Conditions.

C. Each Change Proposal shall be submitted on a Change Proposal form acceptable to Engineer.

1. Number each Change Proposal as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential number. Example: First Change Proposal for the general contract for project named “Contract 23” would be, “Proposal No. 23-001”.

2. In space provided on form:

a. Describe scope of each proposed change. Include text and sketches on additional sheets as required to provide detail sufficient for Engineer’s review and response. If a change item is submitted in response to proposal request, write in as scope, “In accordance with Change Proposal Request No.” followed by the proposal request number. Provide written clarifications, if any, to scope of change.

b. Provide justification for each proposed change. If change is in response to proposal request, write in as justification, “In accordance with Change Proposal Request No.” followed by the proposal request number.

c. List the total change in the Contract Price and Contract Times for each proposed change.

3. Unless otherwise directed by Engineer, attach to the Change Proposal detailed breakdowns of pricing (Cost of the Work and Contractor’s fee) including:

a. List of Work tasks to accomplish the change.

b. For each task, labor cost breakdown including labor classification, total hours per labor classification, and hourly cost rate for each labor classification.

c. Construction equipment and machinery to be used, including manufacturer, model, and year of manufacture, and number of hours for each.

d. Detailed breakdown of materials and equipment to be incorporated into the Work, including quantities, unit costs, and total cost, with Supplier’s written quotations.

e. Breakdowns of the Cost of the Work and fee for Subcontractors, including labor, construction equipment and machinery, and materials and equipment incorporated into the Work, other costs, and Subcontractor fees.

f. Breakdown of other costs eligible, in accordance with the General Conditions and the Supplementary Conditions.

g. Other information required by Engineer.

h. Contractor’s fees applied to eligible Contractor costs and eligible Subcontractor costs.

1.8 CHANGE ORDERS

A. General

1. Change Orders will be recommended by Engineer and signed by Owner, and Contractor, to authorize additions, deletions, or revisions to the Work, or changes to the

Contract Price or Contract Times.

2. Change Orders will be in the form of EJCDC document C-941, “Change Order” or other Engineer’s accepted form.

B. Procedure

1. Five originals of each Change Order will be furnished to Contractor, who shall sign each original Change Order and return all originals to Engineer within five days of receipt.
2. Engineer will sign each original Change Order and forward them to Owner.
3. After approval and signature of all parties, three executed original copies will be returned to Engineer. Engineer will distribute as follows:
   a. Contractor: One original
   b. Owner: One original
   c. Engineer: One original
4. One copy of each Change Order will be distributed to:
   a. Resident Project Representative (RPR)

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 SCHEDULE

A. 2013 EJCDC Form C-942, Field Order

B. 2013 EJCDC Form C-940, Work Change Directive

C. 2013 EJCDC Form C-941, Change Order

** END OF SECTION **

Field Order No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with General Conditions Paragraph 9.04, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference: _____ Specification(s) _____ Drawing(s) / Detail(s)

Description:

Attachments:

ISSUED:	RECEIVED:
By: _____ Engineer (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____
Date: _____	Date: _____

Copy to: Owner

Work Change Directive No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments: [List documents supporting change]

Purpose for Work Change Directive:
Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: [check one or both of the following]

☐ Non-agreement on pricing of proposed change.
☐ Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price $ _____ [increase] [decrease].

Contract Time ____ days [increase] [decrease].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price

☐ Cost of the Work ☐ Other

RECOMMENDED:	AUTHORIZED BY:	RECEIVED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

By: _____ Date: _____

Title: _____

Change Order No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

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
Original Contract Price: $	[note changes in Milestones if applicable] Original Contract Times: Substantial Completion: Ready for Final Payment: days or dates
[Increase] [Decrease] from previously approved Change Orders No. to No. : $	[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
[Increase] [Decrease] of this Change Order: $	[Increase] [Decrease] of this Change Order: Substantial Completion: Ready for Final Payment: days or dates
Contract Price incorporating this Change Order: $	Contract Times with all approved Change Orders: Substantial Completion: Ready for Final Payment: days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer (if required)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved Funding Agency (if required)

By: _____ Date: _____

Title: _____

SECTION 01 31 19
PROJECT MEETINGS

1 GENERAL

1.1 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site.

B. Attendance at preconstruction meeting will include, but not be limited to, the following.

1. Owner
2. Engineer
3. Contractor
4. Major subcontractors
5. Safety representative
6. Representatives of governmental or other regulatory agencies, as required.

C. Minimum Agenda

1. Tentative construction schedule
2. Critical work sequencing
3. Designation of responsible personnel
4. Processing of Field Decisions and Change Orders
5. Adequacy of distribution of Contract Documents
6. Submittal of Shop Drawings and samples
7. Procedures for maintaining record documents
8. Use of site and Owner's requirements
9. Major equipment deliveries and priorities
10. Safety and first aid procedures
11. Security procedures
12. Housekeeping procedures
13. Processing of Partial Payment Requests

1.2 PROGRESS MEETINGS

A. Progress meetings will be held monthly during the performance of the work of this Contract. Additional meetings may be called as progress of work dictates.

B. Engineer will preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.

C. Attendance at progress meetings shall include the following.

1. Owner
2. Engineer
3. Contractor
4. Subcontractors, only with Engineer's approval or request, as pertinent to the agenda

D. Minimum Agenda

1. Review and approve minutes of previous meeting.
2. Review progress of Work since last meeting.

3. Review proposed 30-day construction schedule.
4. Note and identify problems which impede planned progress.
5. Develop corrective measures and procedures to regain planned schedule.
6. Revise construction schedule as indicated and plan progress during next work period.
7. Review quality and work standards.
8. Review work environment.
9. Complete other current business.
10. Schedule next progress meeting.

E. The Contractor shall bring record drawings to each progress meeting for review. Record drawings shall reflect all changes to date. Failure to keep up-to-date record drawings will result in not processing pay requests.

F. The Contractor shall bring updated project schedules to each progress meeting for review. Updated project schedules shall reflect all changes to date. Failure to keep up-to-date project schedules will result in not processing pay requests.

1.3 CALLED MEETINGS

A. The Owner or Engineer may request meetings with the Contractor at any time on matters pertaining to the progress of Work being carried out under this Contract. It will be the responsibility of the Contractor to supply whatever information is requested by the Owner or Engineer concerning the project throughout its duration.

B. Contractor shall make manufacturer representatives and information available on request for meetings the Engineer has with the Owner.

** END OF SECTION **

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULES

1 GENERAL

1.1 DESCRIPTION

A. The Contractor shall submit to the Engineer for approval construction planning, scheduling, and cost value documentation pertaining to the project as detailed herein and shall update same throughout project as required.

B. The following schedules, reports, and plots shall be submitted to the Engineer.

1. Construction Progress Schedule
2. Short Term Schedules
3. Detailed Cost Breakdown/Schedule of Values
4. Activity Reports
5. Equipment and Material Order Schedule
6. Logic Diagrams
7. Resource Plots

C. No Construction Progress Schedule review by the Engineer shall relieve the Contractor from the responsibility to comply with the Contract Times and any sequences of Work indicated in or required by the Contract Documents or to complete Work within the Contract Times. Nor will any such Construction Progress Schedule review by the Engineer lead to approval of, or consent to, any variation from the Contract Documents, except as the Engineer may otherwise approve or consent to individual variations by means of specific, separate notations in writing.

1.2 SUBMITTAL PROCEDURES

A. Within 10 working days of Notice to Proceed, the Contractor shall submit to the Engineer for approval the products required by this section of the Specifications.

B. Within 5 working days following receipt of same the Engineer shall arrange for a meeting with the Contractor so as to familiarize the Engineer with the Contractor's proposed construction plans and schedules.

C. Within 5 working days following the Engineer's review the Contractor shall resubmit a corrected copy of those documents requiring revision.

D. Within 5 working days following his receipt of the adequately revised documents the Engineer will approve same for use on the project.

E. Once approved, the Contractor shall submit 4 copies of the construction scheduling documents to the Engineer for use on the project. The construction scheduling documents shall be marked Rev. 0.

F. The Contractor shall not submit an Application for Payment until the Rev. 0 Construction Progress Schedule and Schedule of Values is approved.

2 PRODUCTS

2.1 GENERAL

A. All construction scheduling documents shall be prefaced with the following summary data.

1. Project Name
2. Contractor
3. Type of Tabulation (Initial or Updated with revision number)

4. Project Duration
5. Project Scheduled Completion Date
6. Effective or Starting Date of the Schedule
7. If an updated (revised) schedule, the new project completion date and project status

2.2 CONSTRUCTION PROGRESS SCHEDULE

A. The Construction Progress Schedule shall be a cost-and-resource loaded critical path method (CPM) progress schedule.

B. The Construction Progress Schedule shall detail CPM activities and logic ties to the extent required to show the Contractor's overall approach to the Work.

C. At a minimum, the Construction Progress Schedule shall include the following.

1. Activity Number
2. Activity Description
3. Estimated Activity Duration (Work Days)
4. Activity Start Date (Calendar Dated)
5. Activity Finish Date (Calendar Dated)
6. Activity Cost of each of the various subdivisions of work required under the Contract Document, Specifications, and Drawings.

D. The Construction Progress Schedule shall clearly define the prosecution of the Work from Notice-to-Proceed to Final Acceptance by using separate CPM Activities.

E. CPM Activities shall equate to the days required to complete the associated work.

F. CPM Activities shall be assigned consistent descriptions, codes, and sort codes.

G. CPM Activity durations shall be depicted in the form of a bar chart.

H. The narrative shall list the CPM Activities on each Critical Path and compare Early and Late Dates for CPM Activities designating Contract Times and Target Times. The narrative shall also recap progress and days gained or lost vs. the current Construction Progress Schedule, describe changes in resources to be used on remaining Work and identify delays, their extent and causes. The narrative shall also itemize changes in Activities, logic ties and detailed cost breakdown pay items by each change, recovery plan and Contractor-initiated revision.

I. Construction Progress Schedules shall be submitted in PDF format.

J. Construction Progress Schedule Updates

1. The Contractor shall update the Construction Progress Schedule at least monthly and indicate those activities whose completion dates are in jeopardy because of activities behind schedule.
2. Updated construction scheduling documents shall be submitted to the Engineer each month at the construction progress meeting.
3. Each monthly Construction Progress Schedule Update shall be marked Rev. 0.1, Rev. 0.2, etc.
4. The Owner may require the Contractor to modify any portions of the work schedule that becomes infeasible because of "activities behind schedule" or for any other valid reason. Any such modification will be at the Contractor's expense unless the modification is required to accommodate schedule revisions required by the Owner.
5. If a revision is required to the Construction Progress Schedule Update submittal, it shall be marked Rev. 0.1A, Rev. 0.1B, etc.
6. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.

K. If a revision is required to the overall Construction Progress Schedule, it shall be marked Rev. 2, Rev. 3, etc.

2.3 SHORT TERM SCHEDULES

A. Short Term Schedules shall subdivide CPM Activities into detailed tasks and cover the prior two (2) weeks and the next four (4) weeks. Each installation task shall be cross-referenced to a CPM Activity and shall not combine the Work for more than one crew. Submittals shall segregate preparation from review and shall not combine items furnished by separate Suppliers.

2.4 DETAILED COST BREAKDOWN/SCHEDULE OF VALUES

A. The Detailed Cost Breakdown (DCB) shall divide the Work into pay items by significant Sections of the Specifications within areas, structures, and facilities, or vice versa. If requested by the Engineer in writing, there shall be separate DCB reports for self-performed Work and the Work of each Subcontractor.

B. The Schedule of Values (SOV) shall subdivide the DCB into CPM and Pay Activities, sequenced by Activity codes, and shall tabulate for each Activity: code, description, Values for labor, Subcontract and/or materials and equipment costs; Activity Values; percent complete; and Earned Values. Delivery and Submittal Review Activities, where appropriate, shall be cost-loaded if the Contractor intends to request payment for stored materials and for approved equipment Shop Drawings, respectively.

1. The Contractor shall establish and submit a cost value for each activity in his progress schedule and estimates so that monthly partial payments to the Contractor can be calculated on the basis of work in place.

2. Wherever in the General Conditions it is provided that payments will be allowed for materials delivered to the site but not yet incorporated in the work, subject to the terms and conditions specified in the General Conditions, separate pay items shall be established for furnishing and installation of such items.

3. Costs of materials delivered to the site but not yet incorporated into the work shall be included as a separate pay item and shall not be included in the cost value of the installation activity for such materials.

4. Each activity shall be limited to a maximum cost of $50,000. Exceptions to this rule may be where a piece of equipment costs more than $50,000.

C. Pay Activities or the features of the software shall be used to ensure that any total CPM Activity Value or, if appropriate, that any Activity labor, Subcontract, etc. Values roll up to only one DCB pay item. Once the Rev. 0 DCB and SOV are approved, the Contractor shall not modify any DCB pay item or Activity Value, unless otherwise authorized by the Engineer in writing.

D. A schedule of the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Construction Progress Schedule shall be included provided. This anticipated monthly payment schedule shall distribute the costs of the project more or less evenly over the scheduled project life in a manner acceptable to the Owner and compatible with the Owner's funding arrangements for the project. Re-submittal will be required until the anticipated monthly payment schedule is acceptable to Owner. For this project, substantial variation from this schedule of payments will not be permitted.

2.5 ACTIVITY REPORTS

A. Activity Reports shall include CPM Activity code, description, duration, calendar, Early and Late Dates (calendar dates), Total Float, labor manhours, and sort codes. The Late Finish Date (or the Early Start Date) of any CPM Activity highlighting a Contract Time (or commencement of all or any part of the Work) shall equal the corresponding Contract Time (or Contract date). In addition, for precedence-based Progress Schedules, Activity Reports shall show, for each CPM Activity, all preceding and succeeding logic ties (lead/lag and lead times) or attach a separate report combining such Activity and logic tie data.

2.6 EQUIPMENT AND MATERIAL ORDER SCHEDULE

A. Equipment and Material Order Schedule shall include the following information for principal items of equipment and materials.

1. Dates on which Shop Drawings are requested and received from the manufacturer
2. Dates on which certification is received from the manufacturer and transmitted to the Engineer
3. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision
4. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer
5. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected"
6. Date on which accepted Shop Drawings are transmitted to manufacturer
7. Date of manufacturer’s scheduled shop test
8. Date of manufacturer's scheduled delivery
9. Date on which delivery is actually made

2.7 LOGIC DIAGRAMS

A. Logic Diagrams shall be arrow or precedence and, once the Engineer has designated timescales, shall be plotted on a time scaled calendar, on minimum 22-inch x 34-inch color sheets. Logic Diagrams shall identify the Contract Times and Critical Path(s). CPM Activities shall be shown on the Early Dates, and Total Floats shall be noted beside the CPM Activities. Logic connectors whether on the same sheet or not, shall identify predecessors and successors.

2.8 RESOURCE PLOTS

A. Resource Plots shall graph monthly (or weekly, if chosen by the Engineer) and cumulative payments and manpower, using current Early Dates and Late Dates and, when requested by the Engineer, comparing Construction Progress Schedule and current Early Dates. The specific trades shall be chosen by the Engineer.

2.9 PROPOSAL SCHEDULES

A. If required, the Contractor shall submit Proposal Schedules, which shall support proposals or claims for changes in Contract Price or Contract Time, schedule recovery plans and other Contractor-initiated Progress Schedule adjustments.

B. A Proposal Schedule Submittal shall include all the reports, schedules, plots, etc. specified for a Progress Schedule Submittal.

3 EXECUTION

3.1 GENERAL

A. Contractor shall take all reasonable actions to maintain the Rev. 0 Construction Progress Schedule.

3.2 DELAY PROVISIONS

A. The Contractor shall promptly take appropriate action to recover schedule whenever the Contractor anticipates, or any Construction Progress Schedule submittal demonstrates, that a CPM Activity will slip, due to acts or omissions within the control of the Contractor, by fifteen (15) or more days beyond any Target Time or Contract Time.

B. If the Contractor is not responsible for such schedule slippage, the Contractor shall give prompt written notice of a delay justifying a Contract Time extension, and follow such notice by taking prompt appropriate action nonetheless, if so directed by the Engineer.

C. If schedule recovery is required, the Contractor shall enclose with the next Construction Progress Schedule submittal a schedule recovery plan consisting of the following.

1. A narrative describing the cause of schedule slippage and the actions taken to recover schedule within the shortest reasonable time
2. A Proposal Schedule with the corresponding revisions in Activities and logic ties and other adjustments. Appropriate schedule recovery actions may include assignment of additional labor, subcontractors or construction equipment; Work during other than normal working hours; re-sequencing of the Work; expediting of submittals and deliveries; and any combination of any of these or other similar actions. Activity shortening and overlapping shall be explained as to their basis (and be supported by increases in resources).

D. If the Contractor believes that an increase in Contract Time is justified, any such extension in Contract Time and associated increase in Contract Price will not be evaluated, unless the following requisites are met.
1. The Contractor, using the procedures in this Section, demonstrates that conditions justifying extensions in Contract Time or increases in Contract Price, or both, have arisen.
2. The Contractor's analysis is verifiable by an independent, objective evaluation by the Engineer, using the data furnished by the Contractor.

E. The Contractor's failure, refusal, or neglect to take appropriate schedule recovery action or, in the alternative, give written notice of a delay, and, in either case, to follow up with a timely Proposal Schedule shall be reasonable evidence that the Contractor is not prosecuting the Work with due diligence. Any such Contractor failure, refusal, or neglect shall give sufficient basis to the Owner, with the Engineer's advice, to elect any of the following.
1. Demand adequate, written assurance of due performance.
2. Increase retainage.
3. Withhold liquidated damages.
4. In the Owner's sole discretion, direct alternate schedule recovery actions.
5. In the event the Engineer is unable to approve any Construction Progress Schedule revision, both the Engineer and Contractor shall be required to use the Rev. 0 Construction Progress Schedule to resolve issues affecting Contract Time and Contract Price.

3.3 CHANGE ORDERS

A. Upon approval of a Change Order by the Owner the approved change shall be reflected in the next submittal by the Contractor.

3.4 MEASUREMENT AND PAYMENT

A. The Contractor represents to have included in the Lump Sum Contract Price all costs for Work under this Section. Payment for Work performed under this Section will be made as part of those payments made on in progress and completed Detailed Cost Breakdown pay items, or using the Earned Values for Progress Schedule Submittal pay items, if any such pay items are established.

** END OF SECTION **

SECTION 01 32 26
CONSTRUCTION PROGRESS REPORTING

1 GENERAL

1.1 DAILY REPORTS

A. The Contractor shall submit daily reports to the Engineer. Reports shall contain, but not be limited to, the following information:

1. Summary of work completed that day.
2. A list of all employees and subcontractors by trade that worked on the job that day.
3. A list of all equipment and materials received.
4. Survey stake-out data collected.
5. Erosion and sediment control maintenance reports.
6. Summary of any critical events from the day, injury reports, etc.
7. Any other information pertinent to the construction project.

** END OF SECTION **

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

1 GENERAL

1.1 SCOPE

A. Furnish all equipment, labor, and materials required to provide the Owner with digital construction photographs and audio/video recordings of the Project.

B. Photos, electronic files, and audio/video recordings shall become the property of the Owner and none of which shall be published without express permission of the Owner.

1.2 PRE AND POST CONSTRUCTION PHOTOGRAPHS

A. Prior to the beginning of any work, take project photographs of the work area to record existing conditions.

B. Following completion of the work, take another set of photos showing the same areas and features as in the pre-construction photographs.

C. Show all conditions which might later be subject to disagreement in sufficient detail to provide a basis for decisions.

D. Submit the pre-construction photographs to the Engineer within 15 calendar days after the date of receipt by the Contractor of the Notice to Proceed. Provide post-construction photographs prior to final acceptance of the project.

1.3 PROGRESS PHOTOGRAPHS

A. Include the date and time marking of the recording on the photographs. Electronically label all photographs to indicate date and description of work shown.

B. Submit a minimum of 10 photographs with each request for payment. The view selection will be as agreed to with the Engineer. Submit electronic photograph files in jpeg format.

1.4 PRE AND POST CONSTRUCTION AUDIO/VIDEO RECORDINGS

A. Prior to the beginning of any work, make audio/video recordings of the work area to record existing conditions.

B. Following completion of the work, make another recording showing the same areas and features as in the pre-construction recording.

C. Show all conditions which might later be subject to a disagreement in sufficient detail to provide a basis for decisions.

D. Include the date and time markings on the video. Provide an audio narration, stating a description of what is shown, structure, area, approximate station of the area shown, and street address and property owner where appropriate for all videos.

E. Submit videos on portable flash drive.

1.5 SUBMITTALS

A. Photographs and videos shall be high resolution electronic versions.

B. Submit the preconstruction photographs to the Engineer within 15 calendar days after the date of the Notice to Proceed. Submit postconstruction photographs prior to final acceptance of the Project.

C. Submit progress photographs with each payment request.

D. Audio/Video Recordings

1. Submit the pre-construction recording prior to the first partial payment request.

2. Submit the post-construction recording with the final payment request.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

** END OF SECTION **

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

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

A. The Contractor shall submit to the Engineer for review and approval complete drawings and engineering data for all equipment, materials, and products to be incorporated into the work. Shop drawings and engineering data shall be provided and the Engineer's review will be conducted in accordance with requirements of the General Conditions. The review of the drawings by the Engineer shall not be construed as a complete check but only for conformance with the contract documents. Review of such submittals will not relieve the Contractor of the responsibility for any errors that may exist, as the Contractor shall be responsible for the dimension and design of adequate connections, details, and satisfactory construction of all work.

B. The term “submittals” shall mean shop drawings, manufacturer’s drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer’s review for conformance with the design concept and compliance with the contract documents.

C. Shop drawings and engineering data shall be prepared by the original equipment vendors or fabricators, as applicable.

D. Each shop drawing and each item of engineering data shall bear the Contractor's approved stamp indicating that the Contractor has reviewed the drawing or data for conformance with the Contract Documents.

E. All design calculations and drawings for sheeting and shoring and concrete formwork shall bear the signed and dated stamp of a licensed professional engineer.

F. No material or equipment shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed and approved by the Engineer and returned to the Contractor. No payments will be made for materials or equipment that do not have approved shop drawings.

1.2 MISCELLANEOUS SUBMITTALS

A. The Contractor shall submit to the Engineer miscellaneous information, procedures, test data, samples, etc., in the manner and at the time specified in these Specifications and Contract Documents. Miscellaneous submittals shall include, but not be limited to, the following:

1. Satisfactory written evidence in the form of laboratory or mill test reports indicating that all cement, aggregate, masonry, castings, steel reinforcement, pipe, grout, grass seed, and other items incorporated into the work are in compliance with requirements of these Specifications.
2. Project record documents.
3. When requested, analysis and design data on concrete formwork and sheeting and shoring.
4. Drawings and details of erosion and sediment control structures.

1.3 SAMPLES

A. At the Engineer's request, the Contractor shall furnish certified samples of materials utilized in the fabrication or production of equipment, materials, and products supplied under these Contract Documents. Cost of all such samples shall be borne by the Contractor. The samples will be tested by a qualified independent testing laboratory selected by the Owner to determine if the mechanical and chemical properties of the materials supplied are in accordance with requirements of these Specifications and Contract Documents. The Owner

will pay for the laboratory testing of material samples provided by the Contractor. The Contractor shall pay for all retests made necessary by the failure of materials to conform to the requirements of these Specifications and Contract Documents.

1.4 CONCRETE CONSTRUCTION

A. Concrete Lift or Pour Sequence Drawings

1. The Contractor shall prepare and submit Drawings using joints indicated on the design drawings of all concrete pours. The sequence Drawings and the sequence of concrete pours shall be the basis of the detailing of any reinforcing steel, or other embedded items. Sequence Drawings shall be legible and shall be ink lined on a reproducible sheet not less than 11x17 inches. A bill of material of embedded items shall be indicated, in addition to the necessary details. No concrete shall be placed until the sequence drawings of the proposed pours have been returned to the Contractor with a notice to proceed. Concrete placed in violation of this requirement may be ordered removed and replaced and such removal and replacement shall be at the expense of the Contractor.
2. Sequence drawings will indicate all dimensions and details necessary for the crafts to build forms and locate embedded items. These dimensions shall be tied to surveying stations, offsets from centerlines, and elevations.
3. Pay quantities shall be calculated and tabulated by bid item number, description, and pay quantity. The reviewed sequence drawing tabulation will be the agreed amount for payment for items involved. Reinforcing steel and embedded items, which are pay items or subsidiary to pay items, shall be included.
4. One copy of layout sheets shall be furnished indicating relative position of all sequence lifts or pours and construction joints.
5. A concrete placement schedule shall be furnished indicating intended pouring date of each sequence. This may be in the form of a bar graph indicating bid item vs. time with sequence numbers noted along each bar.

B. Concrete Reinforcing Drawings

1. Concrete reinforcing drawings will be checked for general arrangement and structural safety; however, responsibility of reinforcing the structures in compliance with design drawings rests entirely with the Contractor. Shop drawings shall have been checked by the Contractor before being submitted. Drawings submitted that have not been checked will not be accepted.
2. Reinforcing details shall consist of a bar schedule, showing the number of bars, marks, sizes, lengths, weights, bending configurations, and an erection drawing indicating location in the structure of all reinforcing bars and accessories as required to support the steel in compliance with the latest American Concrete Institute Detailing Manual 1980 SP-66 and as specified.

1.5 GENERAL SUBMITTAL REQUIREMENTS

A. Submittal Method

1. Submit electronically in Portable Document Format (PDF).

B. Scheduling

1. Where appropriate in various required administrative submittals (listings of products, manufacturers, supplier and subcontractors, and in job progress schedule), show principal work-related submittal requirements and time schedules for coordination and integration of submittal activity with related work in each instance.

C. Coordination of Submittal Times

1. Prepare and transmit each submittal to the Engineer sufficiently in advance of performing related work or other applicable activities, so the installation will not be delayed or improperly sequenced by processing times, including non-approval and re-submittal (if required). Coordinate with other submittals, testing, purchasing, delivery

and similar sequenced activities. No extension of time will be authorized because of Contractor's failure to transmit submittals to the Engineer sufficiently in advance of the work.

D. Sequencing Requirements

1. As applicable in each instance, do not proceed with a unit of work until submittal procedures have been sequenced with related units of work, in a manner which will ensure that the action will not need to be later modified or rescinded by reason of a subsequent submittal which should have been processed earlier or concurrently for coordination.

E. Preparation of Submittals

1. Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for the Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through the Contractor's office will be returned "without action."

F. Transmittal Identification

1. Number transmittals in sequence for each Division of the Specifications. The number before the dash indicates the Section of the Specifications, the number after the dash indicates the number of the submittal related to specification section, and the letter “A” after the second dash indicates the first submittal (40 05 05-001-A would be the first transmittal applicable to Section 40 05 05 of the Specifications, 40 05 05-002-A would be the second transmittal for Section 40 05 05, etc.).
2. Identify re-submittals with succeeding letters of the alphabet following the original number, using “B” for the first re-submittal, “C” for the second re-submittal, etc. A re-submittal affecting transmittal 40 05 05-001-A would then be numbered 40 05 05-001-B. The number 40 05 05-001-A would then be entered in the space "Previous Transmittal Number," which is left blank except on re-submittals.
3. Re-submittals shall include all previous submittal information. No partial submittals will be accepted.

1.6 SPECIFIC CATEGORY REQUIREMENTS

A. General

1. Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal.
    a. Submittals shall contain:
        1) The date of submittal and the dates of any previous submittals.
        2) The project title.
        3) The project number.
        4) The names of the:
            a) Contractor
            b) Supplier
            c) Manufacturer
        5) Identification of the product, with the Specification Section number and equipment tag numbers.
        6) Field dimensions, clearly identified as such.
        7) Relation to adjacent or critical features of the work or materials.
        8) Applicable standards, such as ASTM or Federal Specification numbers.

9) Notification to the Engineer in writing, at time of submittal, of any deviations on the submittals from requirements of the Contract Documents.

10) Identification of revisions on re-submittals.

11) Two 4-inch x 4-inch blank spaces for Contractor and Engineer stamps.

12) Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

13) Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.7 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable) for preliminary check.
2. Contractor to Consulting Engineer for general review or comment.
3. Consulting Engineer to Contractor.
4. Contractor to Supplier.

1.8 ADDRESS FOR COMMUNICATIONS

A. Engineering Strategies, Inc.
3855 Shallowford Road, Suite 525
Marietta, GA 30062
(770) 429-0001

1.9 REVIEW OF SUBMITTALS

A. Review Time

1. Allow 28 days from the date the submittal is received in the Engineer’s office for the Engineer to review and respond to each submittal, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

B. Engineer's Action

1. “No Exception Noted” - Indicates the drawings have been reviewed for conformance with the contract documents and no exceptions have been taken. Proceed with the work.
2. “Furnish as Corrected” - Indicates the drawings have been reviewed for conformance with the contract documents and work may proceed in accordance with all comments. Re-submittal will not be required.
3. “Revise and Resubmit” - Indicates the drawings have been reviewed for conformance with the contract documents, and work may not proceed. After items to which exceptions have been taken are corrected, Contractor shall again submit copies for review.
4. “Rejected” - Indicates the drawings have been reviewed for conformance with the contract documents and are too incomplete or in an unacceptable condition for review. A notation will be made on the shop drawings as to the exceptions taken. Drawings shall be revised and resubmitted for review before proceeding with the work.
5. “Submit Specific Item” - Indicates that one or more items in the submittal were missing or incomplete. Work may commence on any items to which no exceptions were taken; missing or incomplete items must be submitted as noted.

C. Re-submittals

1. Engineer will review a maximum of one re-submittal. If more than one re-submittal is required, the Contractor will be charged the Engineer's standard hourly rate to review the additional submittals.

1.10 DAILY REPORTS

A. The Contractor shall submit daily reports to the Engineer. Reports shall contain, but not be limited to, a list of all employees and subcontractors by trade that worked on the job that day, received equipment and materials, survey stake-out data, erosion control maintenance updates.

** END OF SECTION **

SECTION 01 35 13
SPECIAL PROJECT PROCEDURES

1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for conducting all work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property, and the general public.

B. All construction work shall be conducted in accordance with the latest applicable requirements of Part 1926 of the Occupational Safety and Health Act, Safety and Health Regulations for Construction, Section 107 of the Contract Work Hours and Safety Standards Act, as well as any other local or state safety codes and regulations.

C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring the work is performed safely and in conformance with all applicable regulations. The name and resume of the designated safety supervisor shall be submitted to the Engineer prior to commencing any construction work.

D. The Contractor shall determine for himself the safety hazards involved in executing the work and the precautions necessary to conduct the work safely. If the Contractor is unsure as to any special hazards which may be unique to the various processes and facilities at the treatment plant, it shall be his responsibility to contact the Engineer and request such information in writing prior to beginning the work.

E. The Contractor shall bear all risks associated with performing the work and shall fully indemnify the Owner and Engineer.

1.2 JOB SITE SECURITY

A. Barricades and Lights

1. The Contractor shall furnish and erect barricades, fences, lights, and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the work as necessary.

2. Barricades shall be painted in a color that will be visible at night.

3. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any work under construction.

4. The Contractor will be held responsible for all damage to the work due to failure of barricades, signs, and lights to protect it and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at his cost and expense. The Contractor's responsibility for the maintenance of barricades, signs, and lights shall not cease until the project has been accepted by the Owner.

1.3 SITE ACCESS

A. Access Roads

1. The Contractor shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads shall be located within the property lines of the Owner unless the Contractor independently secures easements for his use and convenience.

3. Existing access roads used by the Contractor shall be suitably maintained by the Contractor at his expense during construction. Contractor shall not be permitted to restrict Owner access to existing facilities. Engineer may direct Contractor to perform maintenance of existing access roads when Engineer determines that such work is required to insure all weather access by the Owner.

B. Parking Areas

1. The Contractor shall construct and maintain suitable parking areas for his construction personnel and equipment on the project site where approved by the Engineer and the Owner.

C. Restoration

1. At the completion of the work, the surfaces of land used for access roads, parking areas, and other construction activities shall be restored by the Contractor to its original condition and to the satisfaction of the Engineer. At a minimum, such restoration shall include establishment of a permanent ground cover adequate to restrain erosion for all disturbed areas.
2. All existing asphalt roadways that are damaged by construction traffic shall be removed and replaced.

** END OF SECTION **

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

1 GENERAL

1.1 GENERAL

A. Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for bids. Such standards are made a part hereof to the extent which is indicated or intended.

1.2 ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
ACI	American Concrete Institute
AGA	American Gas Association
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
AMCA	Air Moving and Conditioning Association
APHA	American Public Health Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
FS	Federal Specifications
HEI	Heat Exchange Institute
IBC	International Building Code
IEEE	Institute of Electronic and Electrical Engineers
ISA	Instrument Society of America
NACE	National Association of Corrosion Engineers
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code
UL	Underwriters Laboratories
WEF	Water Environment Federation

1.3 TRADE NAMES AND MATERIALS

A. Where materials or equipment are specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality of performance, and to establish an equal basis for the evaluation of bids. Where the words "equivalent," "proper," or "equal to", are used, they shall be understood to mean that the item referred to shall be proper, the equivalent of, or equal to the item specified by a trade or brand name, in the opinion or judgment of the Engineer. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be equal to approved samples. Notwithstanding that the words "or equal to", or other such expressions, may be used in the Specifications in connection with a material, manufactured article or process, the material, article, or process specifically designated shall be used, unless a substitute is approved in writing by the Engineer.

1.4 SYMBOLS

A. Symbols and material legends shall be as scheduled on the Contract Drawings.

** END OF SECTION **

SECTION 01 42 19
REFERENCE STANDARDS

1 GENERAL

1.1 GENERAL

A. All materials, equipment, fabrication, and installation practices shall comply with the following applicable Codes and standards, except in those cases where the Contractor's quality standards establish more stringent quality requirements, as determined by the Engineer.

1. Pressure Piping and Tubing
    a. ANSI (American National Standards Institute)
    b. API (American Petroleum Institute)
    c. ASME (American Society of Mechanical Engineers)
    d. AWWA (American Water Works Association)
    e. NSF (National Sanitation Foundation)
2. Materials
    a. ANSI (American National Standards Institute)
    b. ASTM (American Society for Testing and Materials)
3. Painting and Surface Preparation
    a. NACE (National Association of Corrosion Engineers)
    b. SSPC (Steel Structures Painting Council)
4. Electrical and Instrumentation
    a. EIA (Electronic Industries Association)
    b. IEEE (Institute of Electrical and Electronic Engineers)
    c. IPC (Institute of Printed Circuits)
    d. IPCEA (Insulated Power Cable Engineers Association)
    e. ISA (Instrument Society of America)
    f. NEMA (National Electrical Manufacturers Association)
    g. NFPA (National Fire Protection Association)
    h. UL (Underwriter's Laboratories)
5. Aluminum
    a. AA (Aluminum Association)
    b. AAMA (Architectural Aluminum Manufacturers Association)
6. Steel
    a. AISC (American Institute of Steel Construction)
7. Concrete
    a. ACI (American Concrete Institute)
8. Welding
    a. ASME (American Society of Mechanical Engineers)
    b. AWS (American Welding Society)
9. Safety

a. OSHA (Occupational Safety and Health Act)

10. General Building Construction
    a. FM (Factory Mutual Fire Insurance Company)
    b. IBC (International Building Code)
    c. NFPA (National Fire Protection Association)
11. Plumbing
    a. AGA (American Gas Association)
    b. NSF (National Sanitation Foundation)
    c. PDI (Plumbing Drainage Institute
    d. SPC (SBCC Standard Plumbing Code)
12. Refrigeration, Heating, and Air Conditioning
    a. ARI (American Refrigeration Institute)
    b. ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers)
13. Pressure Vessels
    a. ASME (American Society of Mechanical Engineers)

B. In addition, all work shall comply with the applicable requirements of local codes, utilities, and other authorities having jurisdiction.

C. All material and equipment, for which a UL Standard, an AGA approval, or an ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

** END OF SECTION **

SECTION 01 51 00
TEMPORARY UTILITIES

1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The Contractor shall provide temporary light and power, heating, water service and sanitary facilities for his operations and for the construction operations of the Contractor's subcontractors at the site. The temporary services shall be provided for use throughout the construction period.

B. The Contractor shall coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations.

C. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions by the Contractor.

D. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation, and removal shall be borne by the Contractor at no additional cost to the Owner.

E. Some temporary facilities that may be required may be indicated on the Drawings; however, the Drawings do not necessarily show any or all of the temporary facilities that the Contractor ultimately uses to complete the work.

F. Contractor shall not be allowed to use any of the existing facilities or utilities.

1.2 TEMPORARY UTILITIES

A. Temporary Power and Light

1. The Contractor shall provide temporary power facilities required for the proper prosecution and inspection of the work. These facilities shall be installed and maintained by the Contractor and shall be located in such a manner as to result in the least interference with work upon the project site. Temporary power facilities shall remain in place after completion of construction until final acceptance of the work. After final acceptance of the work, the Contractor shall remove temporary power facilities.

2. The Contractor shall provide temporary lighting facilities for the proper prosecution and inspection of the work. These facilities shall be installed and maintained by the Contractor and shall be located in such a manner as to result in the least interference with work upon the project site and existing facilities.

3. The temporary general lighting and small power requirements shall be serviced by 120/240V, 1 phase, 3 wire temporary systems furnished and installed by the Contractor. This service shall be furnished complete with main disconnect, over-current protection, meter outlet, branch circuit breakers, and wiring as required; including branch circuit breakers and wiring as required for furnishing temporary power to the various Contractor's field office service connections, all in accordance with the requirements of the servicing power company and applicable standards and codes. The meter for the temporary 120/240V service for construction purposes shall be registered in the name of the Contractor and all energy charges for furnishing this temporary electric power shall be borne by the Contractor.

4. The Contractor shall make all necessary arrangements, and pay for all permits, inspections, and power company charges for all temporary service installations. Upon completion of the work, but prior to acceptance by the Owner, the Contractor shall remove all temporary services.

B. Temporary Heating

1. Concrete Curing

a. When the mean daily temperature of the atmosphere is less than 40°F, the temperature of concrete shall be maintained between 50°F and 70°F for two days following placement. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature and moisture conditions without injury due to concentration of heat. The Contractor shall provide temporary heat for proper execution of the work.

C. Temporary Water

1. The Contractor shall make the necessary arrangements for securing and transporting all water required in the construction, including water required for mixing of concrete, sprinkling, testing, flushing, flooding, jetting, sanitary facilities, field offices, or cleaning, and including any temporary pipeline or equipment which may be necessary to make use of such water.
2. Water service shall be protected from freezing and the service shall be extended and relocated as necessary to meet temporary water requirements.

D. Potable Water

1. The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, Engineers, and the Owner who are associated with the work progress.

E. Sanitary Facilities

1. The Contractor shall provide sufficient sanitary facilities in proximity to the areas of work for his employees and those employees of his subcontractors. The Contractor will be responsible for continual maintenance and servicing of these facilities.

F. First-Aid Facilities

1. The Contractor shall maintain at a well-known place at the job site, all articles necessary for giving first aid to the injured and shall make standing arrangements for the immediate removal to a hospital or a doctor’s care of persons (including employees) who may be injured on the job site. In no case, shall employees be permitted to work at a job site before the employer has made a standing arrangement (verified in writing to the Owner) for removal of injured persons to a hospital or a doctor’s care.

** END OF SECTION **

SECTION 01 65 00
PRODUCT DELIVERY REQUIREMENTS

1 GENERAL

1.1 GENERAL

A. The Contractor shall provide transportation of all equipment, materials, and products furnished under these Contract Documents to the site of the work. In addition, the Contractor shall provide preparation for shipment and storage, unloading, handling and re-handling, short-term storage, extended storage, storage facilities, maintenance and protection during storage, preparation for installation, and all other work and incidental items necessary or convenient to the Contractor for the satisfactory execution and completion of the work.

B. Any and all materials and products, including spare parts, damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

1.2 TRANSPORTATION

A. All equipment shall be suitably boxed, crated, or otherwise protected during transportation.

B. All equipment shall be shipped and delivered in the largest assembled sections practical or permitted by carrier regulations to minimize the number of field connections.

C. The Contractor shall be responsible for ensuring that the equipment is assembled and transported in such a manner so as to clear buildings, power lines, bridges, and similar structures encountered during shipment or delivery to the site of the work.

D. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.

E. Small items and appurtenances such as gauges, valves, switches, instruments, and probes which could be damaged during shipment shall be removed from the equipment prior to shipment and packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

F. Temporary shipping braces and supports shall be painted orange or yellow for easy identification.

1.3 HANDLING

A. All equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off trucks onto the ground.

D. Items such as nonmetallic pipe, nonmetallic conduit, flagpoles, and lighting poles shall be handled using nonmetallic slings or straps. Slings and Chains shall be padded as required to prevent damage to protective coatings and finishes.

E. All handling, moving, lifting, transporting, and storing of materials including spare parts and other products shall be done in strict accordance with the methods recommended by the respective manufacturers.

** END OF SECTION **

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

1 GENERAL

1.1 GENERAL

A. Equipment shall be received, inspected, unloaded, handled, stored, maintained, and protected by the Contractor in a suitable location on or off site, if necessary, until such time as installation is required.

B. Storage and protection of Contractor-furnished equipment shall be in strict conformance with the requirements of Section 46 00 03, General Equipment Stipulations.

1.2 STORAGE

A. The Contractor shall be responsible for providing satisfactory storage facilities which are acceptable to the Engineer. If satisfactory facilities cannot be provided on site, a satisfactory warehouse, acceptable to the Engineer, shall be provided by the Contractor for such time until the equipment, materials, and products can be accommodated at the site.

B. Equipment, materials, and products which are stored in a satisfactory warehouse acceptable to the Engineer will be eligible for progress payments as though they had been delivered to the job site.

C. The Contractor shall be responsible for the maintenance and protection of all equipment, materials, and products placed in storage and shall bear all costs of storage, preparation for transportation, transportation, re-handling, and preparation for installation.

D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.

E. Unless otherwise permitted in writing by the Engineer, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block, and structural tile may be stored outdoors under a properly secured waterproof covering.

F. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.3 EXTENDED STORAGE

A. If certain items of major equipment such as air compressors, pumps, and mechanical aerators need to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Engineer. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants, and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage. Extended storage shall be defined as any item that is placed on the stored materials list for monthly pay requests.

B. Contractor shall submit to Engineer, manufacturer’s recommended storage procedures for each piece of equipment placed in extended storage.

** END OF SECTION **

SECTION 01 71 13
MOBILIZATION

1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Mobilization shall include the obtaining of all permits, moving equipment onto the site, furnishing and erecting temporary buildings and other construction facilities, and providing utility services, all as required for the proper performance and completion of the Work. Mobilization shall include the following principal items:

1. Moving onto the site all of the Contractor's equipment required for first month operations.
2. Installing temporary construction power, wiring, and lighting facilities.
3. Providing construction water supply.
4. Providing field offices for the Contractor and the Engineer.
5. Providing on-site sanitary facilities and potable water facilities.
6. Arranging for and erection of Contractor's work and storage area.
7. Obtaining all required permits.
8. Having all OSHA required notices and establishment of safety programs.
9. Having the Contractor's superintendent at the job site full time.
10. Submitting initial submittals.

1.2 PAYMENT FOR MOBILIZATION

A. The Contractor's attention is directed to the condition that no payment for mobilization, or any part thereof will be approved for payment under the Contract until all mobilization items listed above have been completed as specified.

B. As soon as practicable after receipt of the Notice to Proceed, the Contractor shall submit a breakdown to the Engineer for approval, which shall show the estimated value of each major component of mobilization.

C. A maximum lump sum payment equal to 1-1/2% of the total Contract amount (to include all bonds, insurance, move-in expenses, etc.) will be allowed for mobilization as a progress payment line item. The actual cost of bonds and insurance (up to the maximum payment of 1-1/2%) will be considered in the initial payment request provided that cost documentation suitable to the Engineer is furnished by the Contractor. Any outstanding balance of the mobilization line item will be payable when the Project work is 10% complete as indicated by the approved progress payments (less cost of mobilization and stored equipment).

** END OF SECTION **

SECTION 01 75 16
STARTUP PROCEDURES

1 GENERAL

1.1 SCOPE

A. Provide all labor, including the services of equipment manufacturer’s representatives, and materials required to perform pre-operational checkout, functional testing, and commissioning of all equipment and mechanical systems installed under this contract.

B. The physical inspection and testing requirements in this Section are in addition to those requirements defined in the technical specifications.

1.2 DESCRIPTION

A. The exact sequence of the facility start-up will depend upon a start-up schedule proposed by the Contractor and reviewed by the Engineer. The facility start-up schedule will be based upon the schedule information generated via the Project Schedule and a priority list of the equipment and systems developed by the Engineer, which are critical and required for startup. The start-up schedule will be updated on a monthly basis, or as directed by the Engineer.

B. It is the Contractor's responsibility to make sure that all Work is completed in time to support field and startup testing. Initial testing of the systems may begin only after the Engineer has received full documentation and certification by the manufacturer and Contractor of the complete and correct installation of equipment associated with the Work. The Contractor shall also certify to the Engineer that all auxiliary systems and components associated with testing have been correctly installed/constructed and completed.

C. All equipment testing and operation shall be witnessed by the Engineer and shall be performed as required to confirm that the Work has been constructed and/or installed properly and will operate satisfactorily under the specified conditions of service. No power is to be turned on to any piece of equipment and no equipment is to be started or tested by the Contractor outside the presence of the manufacturer’s technical representative.

D. The Contractor must verify the integrity of the Work and make any adjustments, calibrations and/or remedial measures required to prepare the Work for acceptance and performance testing.

1.3 SUBMITTALS

A. Submit name, address, telephone numbers, and resume of the proposed field services technicians at least 30 days in advance of the services.

B. Submit test data sheets and performance requirements of each piece of equipment at least 14 days prior to starting related testing.

C. Submit schedule of proposed dates and times for testing and startup activities at least 14 days prior to start of testing.

D. Submit a summary of power, lighting, chemical, water, gas, and other process and utility needs necessary for conducting testing and startup at least 14 days prior to start of testing.

E. Submit a detailed step-by-step description of testing requirements a minimum of 14 days prior to start of testing.

F. Submit field service technicians report summarizing results of pre-operational checkout, including adjustments and pre-tests, prior to conducting functional testing.

G. Submit Manufacturer's Certificate of Proper installation.

H. Submit Test Reports for each piece of equipment or system tested.

I. Submit summary log of all testing and training activities, by specific equipment item, as applicable.

1.4 UNIT RESPONSIBILITY

A. A single manufacturer shall assume unit responsibility for all items so specified in each section. Unit responsibility shall require that all items be products of, or guaranteed by, the manufacturer. The manufacturer shall be responsible for all coordination between components and provide all submittals, installation and start-up assistance and certifications on the equipment as a unit.

1.5 QUALITY ASSURANCE

A. Field service technician shall be competent and experienced in the proper installation, adjustment, operation, testing and startup of equipment and systems being installed. Manufacturer's sales representative and marketing personnel shall not be accepted as field service technicians.

B. Prior to startup and testing, system components shall be flushed with water and hydraulically checked for leaks, cracks, and defects.

C. All systems shall be cleaned and purged as required prior to the pre-operational checkouts.

D. All instruments and controls shall be calibrated through their entire range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made (check that local and SCADA monitoring and control are operational).

E. At no time during testing, startup, and commissioning activities shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

F. No testing of equipment operation shall take place until it has been verified that all lubricants, tools, maintenance equipment, spare parts and O&M manuals have been furnished as specified.

G. All valve and equipment tagging shall be completed prior to startup.

1.6 PRE-OPERATIONAL CHECKOUT

A. During this initial inspection, each piece of equipment is to be evaluated for non-dynamic, non-operational concerns. The focus shall be to confirm the readiness of a unit or system for operation in a normal duty cycle during the functional test period. To the maximum extent practical, the full capabilities of each piece of equipment, including remote operation, instrumented control schemes, alternate modes of operation, and emergency operation, should be available prior to physical checkout in order to facilitate and expedite the transition from physical checkout to functional testing.

B. After the pre-operational checkout is completed, each manufacturer's technical representative and the Contractor shall certify to the Owner, in writing, and on the Manufacturer's letterhead, that the equipment is fully installed in accordance with manufacturer's instructions and operating requirements, and ready to be tested in an operating mode without violation of or voiding any aspect or detail of the manufacturer's warranty.

1.7 PRE-TEST/STARTUP COORDINATION MEETING

A. A pre-test/startup coordination meeting will be conducted by the Engineer to discuss the overall testing and startup program associated with the equipment being provided under this contract. The Engineer will notify the Contractor of the time and place of the meeting. The purpose of this meeting will be to review the testing and startup requirements, review the contractor's testing plan and readiness to begin testing, and develop a startup plan.

B. The Contractor, Engineer, and Owner shall have the required representatives at this meeting.

C. The Contractor shall arrange for attendance of major equipment manufacturer's technical representatives, as needed.

1.8 FUNCTIONAL TESTING

A. After pre-operational checkout is successfully completed, functional testing shall be performed on all equipment. Functional testing shall be conducted and performed using anticipated operational strategies. All field instrumentation, automatic controls and control strategies shall be demonstrated to operate as designed. In the event of failure to demonstrate satisfactory performance of the system or facility, all necessary alterations, adjustments, repairs and replacements shall be made. Functional testing shall consist of operation of the equipment on normal duty cycles for a sufficient period of time to determine satisfactory operation. Test results shall exercise the full capabilities of all equipment including remote and automatic operation, instrumented control schemes, alternate modes of operation, and emergency operation. Functional testing shall be repeated as often as necessary to the satisfaction of the Owner and Engineer, for the specified duration.

B. Certification of functional testing shall be performed by the manufacturer using the services of an authorized representative trained in this type service. Written certification shall be filed with the Engineer on the manufacturer's stationary. Written certification shall indicate that tests were made in accordance with the manufacturer's recommendations, that the test and start-up operation has been satisfactory, and that the equipment is fully operational under design requirements.

1.9 COMMISSIONING

A. After successful completion of functional testing period, system commissioning shall be conducted over a continuous 14-day period. The Owner will furnish all operating personnel (other than vendors of contractor's service personnel) needed to operate equipment during the commissioning period. However, the Owner's personnel will perform their duties under the Contractor's direct supervision. The Owner will be responsible for all operational costs (other than Contractors, subcontractors, or vendor's costs) and the Contractor shall bear the costs of all repairs or replacements required to meet the satisfactory completion of the commissioning. The contractor shall provide all necessary personnel and field service personnel of the major equipment suppliers on an on-call, as-needed basis during commissioning. Until commissioning is completed and units and systems are accepted by the Owner as substantially complete, the Contactor shall be fully responsible for the operational and maintenance of all new facilities and systems. Systems and facilities shall operate satisfactorily continuously through the 14-day commissioning period. After repairs, replacements, alterations, and adjustments are made to correct unsatisfactory performance, the commissioning period will be repeated as necessary until operation has operated continuously to the satisfaction of the Owner.

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 TESTING PREPARATION

A. Prior to starting field testing the Contractor shall:

1. Complete Work associated with the unit and related processes, including providing and coordinating related manufacturer's technical representative services.
2. Furnish related operating and maintenance manuals, and have on hand necessary testing devices, spare parts, and special tools before testing any unit or system.
3. Provide materials and equipment required to conduct testing, and provide all labor required to aid the manufacturer's technical representatives with their inspection and in making required adjustments to all equipment installed under this contract.
4. Calibrate testing equipment for accurate results.
5. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.

6. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
7. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
8. Check power supply to electric-powered equipment for correct voltage.
9. Adjust clearances and torques.
10. Balance HVAC systems, measuring airflow static pressure, and component pressure losses.

3.2 FUNCTIONAL TESTING

A. The Contractor shall:
   1. Begin testing at a time mutually agreed upon by the Owner, Engineer, manufacturer's technical representative(s), and Contractor.
   2. Conduct test until each individual component item or system has achieved 24 continuous hours of satisfactory operation. Demonstrate that all operational features and controls function during this period while in automatic modes.

B. Separate items of equipment demonstrated to function properly during subsystem testing may require no further acceptance test if documentation of subsystem testing is acceptable to Engineer.

C. Startup testing shall not commence until the equipment or system meets unit functional tests requirements specified herein and as required by the manufacturer.

3.3 COMMISSIONING

A. Commissioning follows successful functional testing and includes the process of putting the facility in operating order, final cleaning, adjusting and balancing of equipment, initial operation of equipment, operating equipment and systems, and demonstration and verification of the completed facility as a unit. Unless otherwise specified, startup testing of the entire facility shall be considered complete when the facility has operated in the manner intended for 14 continuous days without a significant interruption. This period is in addition to any training, field, or startup test periods specified elsewhere. A significant interruption will require the commissioning then in progress to be stopped and restarted after corrections are made. Restarting commissioning restarts the 14-day test period.

B. Test Reports: Prior to initiation of the commissioning period, the Contractor shall certify in writing that:
   1. Hydraulic structures, piping systems, and valves have been successfully tested.
   2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational.
   3. Systems and subsystems are capable of performing their intended functions.
   4. Facilities and systems are ready for intended operation.

C. The Contractor shall provide and coordinate manufacturer's startup testing services.

D. Any and all adjustments, repairs, and corrections necessary to complete startup testing shall be coordinated and completed by the Contractor.

E. After the facility is operating, the Contractor shall complete the testing of any items of equipment, systems, and subsystems which could not be or were not adequately or successfully tested prior to startup test period.

F. Substantial completion of the contract will occur after the commissioning of all systems has been completed.

** END OF SECTION **

SECTION 01 77 00
CLOSEOUT PROCEDURES

1 GENERAL

1.1 DESCRIPTION

A. This section covers general project closeout requirements which the Contractor shall be required to perform both during construction and before final acceptance of the project unless otherwise shown on the Drawings or specified elsewhere in these specifications.

1.2 SUBMITTALS

A. Submit prior to processing of application for final payment:

1. Record Documents
2. Manufacturer’s warranties assembled in a separate binder.
3. Complete set of Approved Shop Drawings and Samples
4. Two copies of all Special Bonds, Special Warranties, and Service Agreements.
5. Consent of Surety to Final Payment
6. Releases or Waivers of Liens and Claims
7. Releases from Agreements.
8. Certificates of Inspection and Occupancy if required by local jurisdiction.
9. Registry of training sessions conducted and list of attendees for all manufacturer’s operation and maintenance training session.
10. Registry of final maintenance and lubrication of filter and/or oil lube protected equipment.
11. Registry of all Spare Parts and Special Tools provided to the Owner as required by individual specification sections organized by specification section inclusive of documentation depicting receipt by Owner.
12. Final Application for Payment: Submit in accordance with procedures and requirements stated in General Conditions.
13. A final written tabulation, plus other documentation as may be required, of all taxes, including sales tax, paid by the Contractor to assist the Owner in obtaining sales and/or use tax refunds for eligible materials and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia.

1.3 RELEASE FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor’s operations have not been kept within the Owner’s construction right-of-way.

B. In the event Contractor is unable to secure written releases, inform the Owner of the reasons:

1. Inform Owner of the reasons.
2. Owner or its representatives will examine the site, and Owner will direct Contractor to complete Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Contractor refuse to perform this Work, Owner reserves the right to have it done by separate contract and deduct the cost of same from the Contract Price or require the Contractor to furnish a satisfactory Bond in a sum to cover legal claims for damages.

4. When Owner is satisfied that Work has been completed in agreement with the Contract Documents and terms of side agreement or special easement, the right is reserved to waive the requirement for written release if:
    a. Contractor's failure to obtain such statement is due to the grantor's refusal to sign, and this refusal is not based upon any legitimate claims that Contractor has failed to fulfill the terms of the side agreement or special easement, or
    b. Contractor is unable to contact or has had undue hardship in contacting the grantor.

1.4 FINAL CLEANING

A. At the completion of the work, the Contractor shall:
    1. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.
    2. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.
    3. Employ experienced workmen or professional cleaners for final cleaning.
    4. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.
    5. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
    6. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.
    7. Broom clean paved surfaces; rake clean other surfaces of grounds.
    8. Clean screens on air intake vents.
    9. Upon completion of the work, Contractor shall remove all rubbish from and about the site of the work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the work and leave the site with an appearance acceptable to the Engineer.
    10. The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver over such materials and equipment in a bright, clean, polished and new-appearing condition.
    11. Contractor shall replace dirty filters and burned-out lights as required; clean all glass surfaces and floors and polished so as to leave work in a clean and new appearing condition.
    12. Restoration of Landscape Damage
        a. Any landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.
    13. Restoration of Asphalt Roadways
        a. Any existing roadways damaged by the Contractor's equipment or operations shall be restored to its original condition at the Contractor's expense. Restoration may

include milling and resurfacing or complete removal and replacement. Alligatoring of the asphalt will require complete removal and replacement of the damage areas.

14. Post-Construction Cleanup or Obliteration

    a. The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction.

B. Contractor shall maintain cleaning until project, or portion thereof, is occupied by the Owner.

1.5 LUBRICATION SURVEY

A. A lubrication survey, made by a lubricant supply firm, subject to the approval of the Owner shall be provided and paid for by the Contractor.

B. The lubrication survey shall list all equipment, the equipment manufacturer's lubrication recommendations, and an interchangeable lubricants tabulation standardizing and consolidating lubricants whenever possible.

C. The Contractor shall supply all lubricants, applicators and labor for lubricating the equipment, in accordance with manufacturer's recommendations, for field testing and prior to final acceptance. A supply of required lubricants sufficient for startup and one year of operation shall also be supplied by the Contractor.

D. A copy of the approved lubrication survey shall be furnished to the Engineer prior to final acceptance.

1.6 SPARE PARTS AND SPECIAL TOOLS

A. Provide spare parts and special tools in accordance with Section 01 78 43, Spare Parts, and the individual equipment specifications.

1.7 EQUIPMENT STARTUP SERVICES

A. Equipment startup period, for the training of plant personnel, shall begin after satisfactory completion and acceptance of the field tests and coincidentally with the certified date of substantial completion for the part of the work for which the equipment is included. If the equipment is not covered by a certificate of substantial completion for a part of the work, the period shall begin upon substantial completion of the project.

B. During the equipment start-up period the Contractor shall furnish, at no additional cost to the Owner the services of factory trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:

    1. Assist in the start-up and operations of the equipment.

    2. Assist in the training of plant personnel, designated by the Owner in the proper operation and maintenance of the equipment.

C. The Owner shall provide the necessary plant personnel to be instructed in the operation and maintenance of the equipment. The Owner's personnel shall operate all equipment.

D. The Contractor shall pay for fuel, power, and chemicals consumed up to the date of "certified substantial completion" except as otherwise specified herein.

E. Contractor shall be available to promptly repair all work during the start-up period so as to cause minimum disruption to the total plant operation.

F. Upon completion of a minimum of fourteen (14) consecutive and continuous days of satisfactory operation, or the number of days called for in the Technical Specifications, the Owner will assume operation and operating cost of the equipment. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.

G. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the Contractor shall replace the defective item and the minimum one (1) year guarantee period, or the guarantee period called for in the Technical Specifications for the item shall start after satisfactory replacement and testing of the item.

1.8 FINAL CLEANUP/SITE REHABILITATION

A. Before finally leaving the site, the Contractor shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The Contractor shall leave all equipment, fixtures, and work, which he has installed, in a clean condition. The completed project shall be turned over to the Owner in a neat and orderly condition.

B. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the Contractor shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the Owner.

C. Disposal of Surplus Materials:

1. Unless otherwise shown on the drawings, specified or directed, the Contractor shall dispose of all surplus excavated materials and materials and equipment from demolition, legally, off the site, and shall provide his own suitable, off-site spoil area, or on a site designated by the Owner.

2. The Owner shall have the opportunity to inspect any materials removed prior to disposal by the Contractor. If said materials are determined to be salvageable by the Owner, the Contractor shall transport said material to an area designated by the Owner.

1.9 FINAL INSPECTION

A. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The Contractor will make his final cleaning and repairing, and any portion of the work finally inspected and accepted by the Engineer shall be kept clean by the Contractor, until the final acceptance of the entire work.

B. When the Contractor has finally cleaned and repaired the whole or any portion of the work, he shall notify the Engineer that he is ready for final inspection of the whole or a portion of the work, and the Engineer will thereupon inspect the work. If the work is not found satisfactory, the Engineer will order further cleaning, repairs, or replacement.

C. When such further cleaning or repairing is completed, the Engineer, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the Contractor has complied with the requirements set forth, and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

1.10 HAZARD CONTROL

A. The Contractor shall store volatile wastes in covered metal containers and remove from premises daily.

B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site shall not be allowed.

D. Disposal of volatile wastes into sanitary or storm sewers shall not be allowed.

1.11 PROJECT CLOSE OUT

A. As construction of the project enters the final stages of completion, the Contractor shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to his contract:

1. Scheduling equipment manufacturers' visits to site.
2. Required testing of project components.
3. Scheduling start-up and initial operation.
4. Scheduling and furnishing skilled personnel during initial operation.
5. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the Engineer's "Punch" Lists.
6. Attend to any other items listed herein or brought to the Contractor's attention by the Engineer.

B. Just before the Engineer's Certificate of Substantial Completion is issued, the Contractor shall accomplish the cleaning and final adjustment of the various building components as specified in the Specifications and as follows:
   1. Clean all glass and adjust all windows and doors for proper operation.
   2. Clean all finish hardware after adjustment for proper operation.
   3. Touch up marks or defects in painted surfaces and touch up any similar defects in factory finished surfaces.
   4. Wax all resilient flooring materials.
   5. Remove bitumen from gravel stops, fascias, and other exposed surfaces.
   6. Remove all stains, marks, fingerprints, soil, spots, and blemishes from all finished surfaces, tile, stone, brick, and similar surfaces.

C. In addition, and before the Certificate of Substantial Completion is issued, the Contractor shall submit to the Engineer (or to the Owner if indicated) certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:
   1. Test results of project components.
   2. Certification of equipment or materials in compliance with Contract Documents.
   3. Operation and maintenance instructions or manuals for equipment.
   4. One set of neatly marked-up record drawings showing as-built changes and additions to the work under his Contract.
   5. Any special guarantees or bonds (Submit to Owner).

** END OF SECTION **

SECTION 01 78 23
OPERATING AND MAINTENANCE DATA

1 GENERAL

1.1 SUMMARY

A. Manuals shall be provided for equipment and systems furnished under the Contract that require maintenance, operation, or modification, including any testing or training equipment. Provide manuals for each item of equipment and its component parts.

B. Manuals shall be provided in printed and electronic formats.

C. All manuals shall be in English. Any foreign language portions of off-the-shelf manuals shall be removed.

D. Submittal of manuals as required by this section implicitly coveys the right from the manufacturer to the Owner to reproduce the document for his own use.

1.2 QUALITY ASSURANCE

A. Off-the-Shelf equipment manuals shall be edited and annotated specifically for this Project by personnel trained and experienced in maintenance and operation of described products.

B. The production quality of printed documents shall be equivalent to offset printing. If offset printed (or equivalent) materials are not available, photocopying from original documents using a properly adjusted plain paper copier will be accepted; however, photocopies of materials containing photographs will not be accepted. Photocopies will be de-speckled and contain less than 5% skew.

1.3 MANUAL DESCRIPTION

A. Off-the-Shelf Equipment Manuals: These manuals are the equipment manufacturer's standard pre-printed operation and maintenance manuals, specifically edited for this project as follows:

1. If material covers more than one product type, the applicable information for the equipment supplied shall be clearly indicated by bubbles or arrows. Highlighting that obliterates the information when photocopied or scanned is not acceptable.

2. If material includes equipment information not relevant to the project, this information shall be crossed out or otherwise clearly redacted.

B. System Manuals: If a major equipment item is specified as a "system" (i.e., comprised of components from several manufacturers furnished on this project by a single entity assigned "system responsibility"), the operation and maintenance material for the entire system shall be included in a single manual with appropriate cross-references and indexing.

C. Minor Components: Any equipment items or components that are typically replaced instead of repaired or have no published operation and maintenance material shall be identified by catalog cuts. If catalog cuts are included in the submittal of an Off-the-Shelf or System Manual, the catalog name and number, and the company name, address and telephone number shall be provided on the catalog cut or typewritten on a separate sheet of paper.

1.4 CONTENT OF MANUAL

A. General: All material shall be labeled to identify the specific function that the equipment serves in the facility. The manuals shall contain, at a minimum:

1. Data required to maintain equipment during equipment service life.

2. Complete preventive maintenance instructions required to assure satisfactory performance and longevity of the equipment.

3. Maintenance and overhaul instructions including detailed assembly drawings with part numbers, parts list, and instructions for ordering spare parts.

4. Lubrication instructions listing points to be greased or oiled, recommending type, grade, temperature range of lubricants, and frequency of lubrication.
5. List of electrical relay settings and control and alarm contact settings.
6. Electrical interconnection wiring diagram for equipment furnished, including all control systems.

B. Project Information: Neatly typewritten table of contents for each volume, arranged in systematic order.
1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to content of the volume.
3. List, with each product, name, address and telephone number of:
a. Subcontractor or installer.
b. Maintenance Contractor, as appropriate.
c. Identify area of responsibility of each.
d. Local source of supply for parts and replacement.
e. Manufacturer
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
5. A Table of Contents for each equipment manual that reflects all procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters, and/or sections of each manual.

C. Product Data:
1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
a. Clearly identify specific product or part installed.
b. Clearly identify data applicable to installation.
c. Delete references to inapplicable information.

D. Drawings:
1. Supplement product data with drawings as necessary to clearly illustrate:
a. Relations and component parts of equipment and systems.
b. Control and flow diagrams.
2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

E. Written text, as required to supplement product data for the particular installation:
1. Organize in consistent format under separate headings for different procedures.
2. Provide logical sequence of instructions of each procedure.

F. Copy of each warranty, bond and service contract issued.
1. Provide information sheet for Owner's personnel, give:
a. Proper procedures in event of failure.
b. Instances which might affect validity of warranties or bonds.

G. Equipment Data (for use in Owner’s Computerized Maintenance Management System)
1. Provide equipment data in Excel spreadsheet format:
a. Equipment ID (ISA tag number or as shown on drawings)

b. Sub-unit

c. Description

d. Area (Name of Water Reclamation Facility e.g. Walnut Creek WRF)

e. Equipment Type (e.g. check valve)

f. Manufacturer

g. Model Number

h. Serial Number

i. Building

j. Building Level

1.5 FORM OF SUBMITTALS

A. Prepare data in printed format as an instructional manual for use by Owner's personnel as required.

B. Format for Printed and Bound Document:

1. Size: 8-1/2 inches x 11 inches.

2. Paper: 20 pound minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings:

a. Provide reinforced punched binder tap, bind in with text.

b. Whenever possible, material shall be 8-1/2 inches by 11 inches or 11 inches by 17 inches z-folded to 8-1/2 inches by 11 inches. If necessary, materials larger than 11 inches by 17 inches may be provided; however, they shall be folded to approximately 8-1/2 inches by 11 inches so that the title block is clearly visible without unfolding.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

a. Provide typed description of product, and major component parts of equipment.

b. Provide mylar-reinforced indexed tabs, labeled on both sides. Slide-in type tabs are not acceptable.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

a. Title of Project.

b. Identity of separate structure as applicable.

c. Identity of general subject matter covered in the manual.

7. Binders:

a. Commercial quality three post binders with durable, cleanable covers and clear plastic slip-in pockets on cover and spine.

b. Maximum Post Width: 2 inches.

c. Color of binders to be selected by the Owner.

d. When multiple binders are used, collate the data into related consistent groupings.

C. Electronic Format:

1. O&M manuals are to be produced in Adobe Acrobat’s Portable Document Format (PDF). Normal drawing orientation shall be maintained.

2. Create one PDF document (PDF file) for each equipment O&M Manual. The entire manual shall be created as a single PDF file via scanning or other conversion method. Drawings or other graphics must be converted to PDF format and made part of the one

PDF document. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

3. Images shall be scanned at a resolution of 300 dpi or greater. Perform Optical Character Recognition (OCR) capture on all images, using capture option that ensures text is searchable and selectable. Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
4. Create bookmarks in the navigation frame, for each entry in the Table of Contents. Three levels deep is usually enough (i.e., “Chapter,” “Section,” “Sub-section”).
5. Thumbnails must be generated for each PDF file.
6. Set the opening view for PDF files as follows:
    a. Initial View: Bookmarks and Page
    b. Magnification: Fit in Window
    c. Page Layout: Single Page
7. Set the file to open to the cover page of the manual, with bookmarks to the left, and the first bookmark linked to the title page.
8. Fill out the Document Properties Description as follows:
    a. Title: Enter the Title of the O&M Manual, e.g. “Return Sludge Pump.”
    b. Subject: Enter the Subject “Operation and Maintenance Manual.”
    c. Author: Enter the name of the Equipment Vendor, e.g. “Acme.”
    d. Keywords: Enter the word “Facility”, followed by the Owner’s facility name. Enter the word “Specification”, followed by the submittal specification section number.
9. Submit final versions of the O&M manuals on compact disks. Label the CDs and the jewel cases as follows:
    a. Facility Name.
    b. Manufacturer Name.
    c. Equipment name and O&M title spelled out in complete words. (example: “Operations and Maintenance Manual” “Submersible Pumps”).
    d. Specification Section No. (example: “Section 11245”).
    e. Date and file name (example: “01-23-2016,” “11245_01.PDF”).

1.6 SUBMITTAL SCHEDULE

A. Submit one hard copy and an electronic copy of the draft Operation and Maintenance Manual for review prior to the shipment of the equipment. Payment for the particular item of equipment, whether stored or installed, will limited to 75% of the invoiced equipment value until submittal is made.

B. Submit two hard copies and two electronic copies of the final Operation and Maintenance Manuals, incorporating any review comments by the Owner, no later than thirty days prior to the scheduled date for training on the equipment. Applications for Payment will not be processed by the Owner, or the amount of payment may be reduced, until the proper material is submitted.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01 78 36
WARRANTIES AND BONDS

1 GENERAL

1.1 PROJECT MAINTENANCE AND WARRANTY

A. Maintain and keep in good repair the improvements covered by these drawings and specifications during the life of the contract.

B. The Contractor shall warrant for a period of one (1) year from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.

C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one (1) year warranty described above, the affected unit shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new one (1) year warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failures shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear, or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication, and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one (1) year warranty. Should multiple failures occur in a given time, all products of the same size and type shall be disassembled, inspected, modified or replaced, as necessary and re-warranted for one (1) year.

E. The Contractor shall, at his own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals or shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by him. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one (1) year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the Owner of the road to make such repairs, the Contractor shall reimburse the Owner of the road for the cost of such repairs.

H. In the event the Contractor fails to proceed to remedy the defects of which he has been notified within fifteen (15) days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the drawings and specifications, and to hold the Contractor and the sureties on his bond liable for the cost and expense thereof.

I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at his home office.

J. After the Owner has made final acceptance of the work, the Contractor shall provide written notice to the Owner and Engineer of the agreed-upon start and end date for the one (1) year warranty period.

K. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of construction.

1.2 MANUFACTURER WARRANTIES

A. Manufacturer warranties shall be assembled and submitted as part of the informational submittals to be submitted as part of the project closeout procedures per Section 01 77 00, Closeout Procedures.

** END OF SECTION **

SECTION 01 78 39
PROJECT RECORD DRAWINGS

1 GENERAL

1.1 SCOPE

A. The work under this includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.

B. Record documents to be prepared and submitted by the Contractor include, but are not limited to Record Drawings, Specifications, Change orders and other modifications to the Contract, Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums, Reviewed shop drawings, product data and samples, Test records, and Record drawings.

C. The Contractor shall maintain on the Project site an updated set of Record Drawings.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in the Contractor's field office, apart from documents used for construction. Provide files and racks for storage of documents. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with format of these Specifications.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes. Maintain at the site for the Owner one copy of all record documents.

D. Make documents and samples available at all times for inspection by Engineer and Design Consultant.

E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.3 QUALITY ASSURANCE

A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.01 foot for all pertinent items constructed by the Contractor.

1.4 SPECIFICATIONS

A. Legibly mark each section to record changes made by Requests for Information (RFI), field order, clarification memoranda, or by change order.

1.5 SUBMITTAL

A. At contract closeout, deliver Record Documents to the Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing Date, Project title and number, Contractor's name and address, Title and number of each record document, and Signature of Contractor or Contractor's authorized representative.

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 RECORD DRAWINGS

A. The Contractor must maintain an up-to-date field record set of drawings by marking changes and other information directly on a clean set of full-size contract drawings. The Engineer will periodically review the record drawings to confirm that the recorded information is current.

B. Making Entries on Record Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
    a. Color Coding:
        1) Green when showing information deleted from Documents.
        2) Red when showing information added to Documents.
        3) Blue and circled in blue to show notes.
2. Date all entries.
3. Legibly mark to record actual changes made during construction, including, but not limited to:
    a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
    b. Horizontal and vertical locations of existing and new underground facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
    c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
    d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
    e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

** END OF SECTION **

SECTION 01 78 43
SPARE PARTS

1 GENERAL

1.1 SCOPE

A. The Work covered by this section includes furnishing all spare parts as identified in the individual equipment specifications.

1.2 SUBMITTALS

A. Provide a list of all spare parts and tools to be provided as part of the Work, including manufacturer/supplier name and contact information.

B. Provide a list of other spare parts not specified to be provided in the individual equipment specifications that are recommended by the manufacturer to assure efficient operation of the equipment for a period of 120 days for the particular installation.

1.3 SOURCE OF SUPPLY

A. Provide spare parts manufactured by the original equipment manufacturer.

B. Provide maintenance materials identical to those installed.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by Owner.

B. Deliver and store items in original factory packaging or other securely packaged form.

C. Identify, on carton or package, manufacturer’s name, name of item, and part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.

D. Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.

E. Stored items shall remain in Contractor's care, custody, and control until acceptance of the Work. Protect stored items against theft or damage.

F. Handle items as necessary, until stored in permanent locations designated by Owner.

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 GENERAL

A. Furnish parts and materials in manufacturer’s unopened cartons, boxes, crates, or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. Clearly mark and identify packaging as to their contents and storage instructions.

B. Furnish special tools in painted metal tool boxes properly labeled and equipped with good grade cylinder locks and duplicate keys.

C. Deliver parts and materials to the Owner upon completion of the Work or when the Owner assumes partial utilization in accordance with the specifications.

D. Provide a letter of transmittal including the following:

1. Date of letter and transfer of parts and materials.

2. Contract title and project number.
3. Contractor’s name and address.
4. A complete inventory of the parts and material listing the applicable specification section for each.
5. A place for the Owner to sign and signify receipt of the parts and materials.

E. Maintain responsibility for loss or damage to parts and materials until they are received and accepted by the Owner.

** END OF SECTION **

SECTION 01 79 00
DEMONSTRATION AND TRAINING

1 GENERAL

1.1 SCOPE

A. The Work covered by this section includes training the Owner in the operation and maintenance of all new equipment, valves, systems, etc.

1.2 SUBMITTALS

A. Approved Operation and Maintenance Manuals

B. Video recordings of training classes recorded on USB flash drive

1.3 QUALITY ASSURANCE

A. Training classes shall be conducted by an instructor who is certified by the manufacturer and is qualified in the operation and maintenance of the particular equipment. Any instructor who is not a direct employee of the manufacturer must provide documentation from the manufacturer stating the individual, by name, has been formally trained in the installation, operation, and maintenance of the equipment and is authorized to train the Owner in the operation of the equipment.

1.4 TRAINING

A. Manufacturer shall conduct two (2) training classes for the Owner's personnel. The training classes shall be conducted on two consecutive days and during regular working hours.

B. Training classes shall not be conducted concurrently with startup and testing; therefore, manufacturer shall allow for additional trips to the project site.

C. Training classes shall not be scheduled or conducted until the manufacturer has certified that the equipment is properly installed and operational; Operation and Maintenances Manuals are finalized and approved; as-built drawings are submitted; valve, equipment and piping identification is complete; and all software programming is complete.

D. Training classes shall be scheduled with the Owner a minimum of one (1) week prior to conducting the class.

E. Contractor shall provide a professional videographer to videotape each training class.

1. Each training class shall be recorded on a separate video. Do not combine training classes on one video.
2. Video shall be high quality using a video camera with minimum 1080p display resolution.
3. Tripod(s) shall be used so that the video image is stable.
4. Microphones shall be used so that audio is clear and audible.
5. Video shall be recorded on USB flash drives.
6. Provide typed labels with the following information.
    a. Project title
    b. Equipment name
    c. Date of recording
7. Two copies of each video shall be provided.

** END OF SECTION **

SECTION 03 01 00
MAINTENANCE OF CONCRETE

1 GENERAL

1.1 SUMMARY

A. Scope

1. Concrete repairs include the following:

a. Restoration of damage concrete from the removal of existing equipment or supports.

B. Requirements

1. Furnish all materials, labor, equipment, tools, etc., required for the repair, renovation, and replacement of concrete and/or reinforcing steel as indicated on the Drawings, specified herein, and determined by field survey.

1.2 REFERENCES

A. Reference Standards

1. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
2. SSPC-SP13 Surface Preparation of Concrete

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings

1. Determine, in conjunction with the Engineer, the extent of cracked or deteriorated concrete to be rehabilitated and/or resurfaced. Submit summary of work to Engineer for approval prior to commencement of work.

B. Sequencing

1. Provide a written Sequencing Plan with the proposed dates and times of construction and shutdown events a minimum of 14 days in advance of planned activities for approval by the Owner.
2. Coordinate all construction sequencing and required shutdowns with Owner in writing.

C. Scheduling

1. Notify the Owner, in writing, at least fourteen (14) days prior to taking existing operational components out of service.
2. Owner employed inspectors may be present throughout the project duration. Provide adequate time and access for inspections for the following major activities:

a. Pre-surface preparation

b. Monitoring of surface preparation

c. Post-surface preparation

d. Monitoring of repair and resurfacing product application

e. Post repair and resurfacing products

1.4 SUBMITTALS

A. Action Submittals/Informational Submittals

1. Product Data

a. Manufacturer’s product data and material data sheets for each proposed repair product.

b. Manufacturer’s application recommendations specific to environmental conditions

and substrates repaired.

c. Submit to the Engineer for approval, alternative materials and/or methods of work proposed to assure the durability and watertight integrity of the repair work.

d. Provide documentation the proposed aggregates comply with ASTM C33.

2. Work Summary

a. Summary of repair work.

3. Shop Drawings

a. Shop Drawings detailing repair procedures and any planned deviation from the proposed construction sequence and/or method of repair indicated in the contract documents.

4. Certificates

a. Furnish affidavits from the manufacturer certifying materials furnished conform to the requirements specified and concrete repair and coating products (if applicable) have been checked for compatibility.

5. Manufacturer’s Instructions

a. Manufacturer’s instructions for each proposed repair product.

6. Field Quality Control Submittals

a. Field Data Reports

7. Qualification Statements

a. Subcontractor/Applicator qualifications as specified in the Quality Assurance Section.

8. Special Procedure Submittals

a. Product Warranty

B. Closeout Submittals

1. Maintenance Contracts

a. Final certified warranty

2. Record Documentation

a. As-built drawings complete with repair descriptions and limits.

b. Photos taken before, during, and after repairs are completed.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

a. Specialize in manufacturing products specified in this section.

b. Minimum of five (5) continuous years of experience for performance in similar applications in the water and wastewater industry.

2. Applicators

a. Furnish the name of all subcontractors/applicators proposed for this work, including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, urethane, and polymer-modified mortars and grouts. Applicator qualifications include:

1) A minimum of five (5) years experience in applying epoxy, urethane, and polymer-modified and cement-based compounds similar to those specified in this Section.

2) A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating the

subcontractor/applicator is trained in the proper techniques for applying the product, including surface preparation and mixing, placing, curing, and caring for the manufacturer's products. In addition, provide confirmation the subcontractor/applicator is on the manufacturer's approved list of contractors.

3. Testing Agencies
    a. The owner may employee inspection and materials testing agencies to perform field quality control tests
    b. Contractor shall be responsible for cost of any additional tests and investigations of work required due to failure of the preformed work to meet the Specifications.
    c. Quality control testing includes compression tests per ASTM C109. Compression test specimens will be taken during construction from the first placement of each type of cementitious mortar and at intervals thereafter to ensure continued compliance with Specifications. A set of three specimens will be made for testing at seven days, 28 days, and any additional time period necessary. Specimen for cementitious mortar testing will be constructed from the first placement of each type of mortar of each day.
    d. All repair materials, already placed, failing to meet the requirements of Specifications, is subject to removal and replacement at no additional cost to the Owner.

B. Certifications
    1. Applicator currently certified in International Concrete Repair Institute (ICRI).

C. Field Data Records
    1. Maintain daily Quality Assurance Records including the following:
        a. Date
        b. Atmospheric Temperature and Humidity
        c. Substrate Temperature
        d. Product Batch Numbers
        e. Mixing Time for Each Part and the Combined Parts of a Repair Materials
        f. Pot Life
        g. Location of Placement
        h. Curing Time of Materials
        i. Foreman or Supervisor's Signature

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements
    1. Comply with the requirements of Section 01 65 00 – Transportation and Handling.
    2. Reject and remove any product showing deterioration, or exposed to any other adverse handling and storage condition possibly causing damage.

B. Storage and Handling Requirements
    1. Comply with the requirements of Section 01 66 00 – Storage and Protection
    2. Provide extra care as necessary to protect materials during cold weather construction.
    3. Remove and replace any product or material damaged during shipment.
    4. Properly package and protect products during shipping, handling, and storage.
    5. Provide an area for repair material storage free from exposure to moisture in any form, before, during, and after delivery to the site.
    6. Deliver and store materials in unbroken containers labeled with the manufacturer's

name and product type. Store all mortar products on raised platforms. Store materials susceptible to freezing damage in a dry, heated, insulated area.

7. Reject and remove any material that has hardened, partially set, become caked and/or has been contaminated or deteriorated.
8. Store all aggregates in clean bins, scows or platforms.

1.7 WARRANTY

A. Provide guarantee on all repair work performed under this Contract against defects in workmanship resulting in leakage and/or failure of concrete bond for a period of two years from the date of the Certificate of Substantial Completion.

2 PRODUCTS

2.1 MATERIALS

A. Mixing Water
   1. Clear, potable, and free of deleterious substances.
B. Aggregate
   1. ASTM C33
   2. Pea Gravel
      a. Meets the gradation and material requirements of Standard Size 14 per ASTM C33.
      b. Clean and free from deleterious matter and contains no limestone.
C. Epoxy Bonding Agent
   1. ASTM C881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. Confirm Epoxy Bonding Agent class is suitable for all ambient and substrate temperatures.
   2. Acceptable Products:
      a. "Sikadur Hi-Mod Series” by the Sika Corp, Lyndhurst, NJ
      b. "CR 246" by Sto Corporation, Atlanta, GA
      c. "Duralbond" by Euclid Chemical Company, Cleveland, OH
      d. "Euco #452 Series" by Euclid Chemical Company, Cleveland, OH
      e. "MBT Concresive Series" by BASF Construction Chemicals.
      f. Engineer approved equal
D. Anti-corrosion Rebar Coating
   1. Two or three-component, epoxy-modified cementitious material.
   2. Acceptable Products:
      a. "Sika Armatec 110 EpoCem " by Sika Corp., Lyndhurst, NJ
      b. "CR 246" by Sto Corporation, Atlanta, GA
      c. "Duralprep A.C." by the Euclid Chemical Company
      d. "MBT Emaco P24" by BASF Construction Chemicals
      e. Engineer approved equal
E. Structural Crack Repair Material
   1. Two-component, polymer-modified or silica fume enhanced cementitious mortar
   2. Conform to EPA/USPHS standards for surface contact with potable water supplies.
   3. Acceptable Products:

a. "Sikatop 123 Plus" by Sika Corp., Lyndhurst, NJ
b. "Emaco S88 CI" by BASF Construction Chemicals
c. "MBT Waterplug" by BASF Construction Chemicals
d. Engineer approved equal

F. Epoxy Crack Repair Binder
1. Two-component, 100% solids, high-modulus, low viscosity epoxy adhesive designed for structural repair.
2. Acceptable Products:
a. "Sikadur 52" by Sika Corp., Lyndhurst, NJ
b. "Duralcrete LV" by Euclid Chemical Company, Cleveland, OH
c. "Sto Poxy Binder CR633" by Sto Corporation, Atlanta, GA
d. "Eucopoxy Injection Resin" by the Euclid Chemical Company
e. "Concresive Standard LVI" by BASF Construction Chemicals
f. Engineer approved equal

G. Waterproof Injection Grout
1. One-component, water-activated polyurethane hydrophilic injection grout capable of 700% expansion. A hydrophobic injection grout may be used where specifically indicated in the contract documents.
2. To form a tough flexible foam seal that is impenetrable to water. Types include:
a. Hydrophilic injection grout:
1) "Prime Flex 900 XLV" by Prime Resins, Conyers, GA
2) "Scotch-Seal Chemical Grout 5600" by Avanti International Webster, TX
3) "Hydro-Active Sealfoam" by De Neef Construction Chemicals, Houston, TX
4) "Concresive 1210-IUG" by BASF Construction Chemicals
5) Engineer approved equal.
b. Hydrophobic injection grout:
1) "Prime Flex 920" by Prime Resins, Conyers, GA
2) "Sikafix HHLV" or "Sikafix HHPlus" by Sika Corp., Lyndhurst, NJ
3) "Hydro-Active Flex" by De Neef Construction Chemicals, Houston, TX
4) "Concresive 1230-IUG" by BASF Construction Chemicals.
5) Engineer approved equal

H. Resurfacing and Spall Repair Patching Material
1. Repairs depths less than 3 inches thick and formwork is not required:
a. Two-component, polymer-modified non-shrink cementitious mortar.
b. Minimum 28-day compressive strength of 7,000 psi.
c. Acceptable products for spall repair mortar for use in horizontal applications:
1) "Sikatop 122 Plus" by Sika Corp., Lyndhurst, NJ
2) "CR 700" by Sto Corporation, Atlanta, GA
3) "Eucocrete Supreme" by the Euclid Chemical Company
4) "MBT SD-2" or "Emaco R310" by BASF Construction Chemicals
5) Engineer approved equal

d. Acceptable products for spall repair mortar for use in vertical applications:
    1) "Sikatop 123 Plus" by Sika Corp., Lyndhurst, NJ
    2) "Duraltop Gel" by Euclid Chemical Company
    3) "CR 702" by Sto Concrete Restoration Division, Atlanta, GA
    4) "Verticoat or Verticoat Supreme" by the Euclid Chemical Company
    5) "MBT Gel Patch" or "HB-2" by BASF Construction Chemicals
    6) Engineer approved equal

I. Waterproof Membrane Patch
1. A hypalon sealing strip secured to the concrete substrate with an epoxy adhesive.
2. Approved product: "Sikadur Combiflex" by Sika Corp., Lyndhurst, NJ, or Engineer approved equal.
3. Minimum width of waterproof membrane patch is twelve (12) inches unless shown otherwise on Contract Drawings.

J. Cement Based Textured Coating
1. Ability to seal cracks with a width up to 1/8 inch.
2. Acceptable Products:
    a. "SikaTop 144" by Sika Corp., Lyndhurst, NJ
    b. "Thoroseal/Acryl 60" by BASF Construction Chemicals
    c. "Duraltop Coating" by Euclid Chemical Company, Cleveland, OH
    d. "Eucoseal or Tamoseal" by the Euclid Chemical Company
    e. Engineer approved equal.

K. Expansion Joint Sealant
1. Multi-component, non-sag, low-modulus polyurethane rubber sealant per ASTM C920, Type M, Grade NS, Class 25, use NT, M, A, and O.
2. Capable of withstanding 50% in extension or compression.
3. Acceptable Products:
    a. Sikaflex-2C NS/SL, by Sika Corporation
    b. Sonolastic NP-2 by Pecora Corporation
    c. Sonneborn by Pecora Corporation
    d. DynaTrol II by Pecora Corporation
    e. Engineer approved equal.

3 EXECUTION

3.1 GENERAL

A. Admixtures
1. No admixtures, except those required by the manufacturer.

B. Manufacturer’s Instructions
1. Prepare surfaces and apply products in strict accordance with manufacturer's recommendations.

C. Inspections
1. Install safe scaffolding and ladders for pre-work inspection, inspection of repair work activities, and the final inspection.

D. Curing

1. Cure repair products in strict accordance with manufacturer’s recommendations.
2. Duration: fourteen (14) days minimum, unless otherwise recommended by the manufacturer.

3.2 EXAMINATION

A. Verification of Conditions

1. Provide photos of conditions prior to surface preparation.
2. Verify ambient conditions (temperature, humidity, etc.) are within manufacturer's recommendations prior to beginning and throughout the repair work.
3. Identify and record locations of cracks, leaks, and surface defects.

3.3 SURFACE PREPARATION

A. Protection of In-Place Conditions

1. Protect all equipment from damage. Wrap sensitive equipment in plastic and tape. Ensure wrappings and protective covers do not interfere with the complete coverage of the underlying concrete repair materials. Equipment may be removed and replaced as approved by Owner.

B. Surface Preparation

1. Sandblast or water blast (3000-4000 psi water jet) deteriorated areas to remove all loose concrete, existing coatings, unsound material, debris, and laitance. Clean and remove loose particles, dirt, grease, and deleterious substances and prepare according to manufacturer's requirements. Ensure moisture conditions on the surface to receive the repair materials are within the manufacturer’s recommended range prior to beginning and throughout the application.

3.4 PRODUCT APPLICATION

A. Epoxy Bonding Agent

1. Apply an epoxy bonding agent when applying fresh concrete to previously placed concrete.
2. Roughen existing concrete surfaces prior to application of bonding agent.
3. Clean concrete surfaces to remove all foreign particles and laitance.
4. Verify prepared concrete surfaces are in sound condition.
5. Place repair materials while bonding agent is still tacky. If bonding agent cures prior to placement of repair material, reapply bonding agent.
6. Repairing concrete with epoxy mortars: ACI 503.4 "Standard Specification for Repairing Concrete with Epoxy Mortars" (latest edition), except as modified herein.

B. Anti-Corrosion Rebar Coating

1. Protect all reinforcing steel cut or exposed during demolition and/or repair operations with an anti-corrosive coating.
2. Sandblast and clean reinforcing steel cut or exposed during demolition and/or repair operations prior to coating with an anti-corrosive coating.
3. Apply anti-corrosive coating as soon as the reinforcement is exposed and cleaned. Thoroughly cover all exposed parts of the steel with coating.

C. Structural Crack Repair Material

1. Repair all existing structural cracks 1/16" and wider with a structural crack repair material.
2. Rout crack to 3/4" wide by 3/4" deep V-notch to expose sound concrete.
3. Where rebar has deteriorated, route crack to expose 3/4" all around rebar. Patch the

resulting void in concrete flush with the existing concrete surface using structural crack repair material.

D. Epoxy Crack Repair Binder

1. Repair all existing structural cracks 1/4" or smaller by pressure injecting an epoxy crack repair binder into the prepared crack.
2. Seal crack surface and install injection ports per manufacturer's recommendations.
3. Do not damage reinforcement while drilling holes for injection ports. If reinforcement is encountered during drilling, abandon hole and relocate. Patch the abandoned hole immediately with non-shrink grout flush with the surface of the existing concrete.
4. Once the surface sealing material has cured, inject crack with epoxy crack repair binder using standard pressure injection equipment as directed by the manufacturer.
5. Repair all existing structural cracks wider than 1/4" by gravity feeding an epoxy crack repair binder into the prepared crack.
6. Route the concrete surface to form a 1/4" wide by 1/4" deep v-notch and clean the crack to remove all loose and foreign particles.
7. Fill the crack with clean, dry sand and then pour epoxy crack repair binder into V-notch, completely filling crack.
8. Apply additional binder to the V-notch as binder penetrates into crack.

E. Waterproof Injection Grout

1. Water-activated polyurethane hydrophilic chemical grout, unless otherwise indicated on the Drawings
2. Repair all existing, leaking cracks 1/4" or smaller by pressure injecting a waterproof injection grout into the prepared crack.
3. Seal crack surface and install injection ports per manufacturer's recommendations.
4. Do not damage reinforcement while drilling holes for the injection ports. If reinforcement is encountered during drilling, abandon hole and relocate. Patch the abandoned hole immediately with non-shrink grout flush with the surface of the existing concrete.
5. Once the surface sealing material has cured, inject crack with waterproof injection grout using standard pressure injection equipment as directed by the manufacturer.

F. Spall Repair Patching Material

1. Chip back all voids or spalled areas to sound concrete. Remove concrete to 1/8" beyond sound concrete. Notify Engineer if concrete reinforcement is exposed or if depth of deteriorated concrete exceeds two (2) inches.
2. Clean substrate in accordance with manufacturer’s requirements. Sawcut concrete, to a minimum depth of 1/2 inch, around the patch perimeter to prevent the repair mortar from feathering at the existing concrete surface.
3. Repair with spall repair patching material.
4. Provide a final finished surface which is flat, level and even with the existing concrete surface.
5. Provide a broom finish consistent with the finish on the existing structure.

G. Resurfacing Material to Receive Protective Coating

1. Prepare, clean and inspect interior concrete surfaces in accordance with SSPC-SP13/NACE No. 6, providing minimum surface profile of ICRI Technical Guideline No. 03732 CSP5 or greater. Evaluate surface for severe service criteria. Remove concrete to 1/8” beyond sound substrate.
    a. Where exposed reinforcement is encountered in cast-in-place concrete substrates remove concrete to 1/2” minimum behind reinforcement.

b. Where exposed reinforcement is encountered in thin wall precast concrete circular structures Consult precast concrete manufacturer prior to proceeding with repair.

c. Where multiple reinforcing bars are encountered, allow evaluation by qualified engineer prior to proceeding with repair.

d. Clean all exposed rebar and protect with anti-corrosion rebar coating.

2. Repair areas to receive a protective coating, where the surface deterioration is less than or equal to 1/2 inch (as measured from the final finished surface to the prepared surface to be repaired), with skimcoats of epoxy modified cementitious mortar per section 09 97 23 – Special Concrete Coatings.

3. Repair areas to receive a protective coating where the surface deterioration is greater than 1/2 inch, to final finished surface, using Resurfacing and Spall Repair Patching Mortar. Notify Engineer if depth exceeds 2 inches.

4. Prime areas to receive a Spall Repair Patching Material with a modified polyamine epoxy. Smooth the repaired surface with primer to prevent outgassing of the coating.

5. Apply Resurfacing and Spall Repair Patching Material in accordance with manufacturer recommendations to rebuild concrete surface. Provide a final finished surface which is flat, level and even with the existing concrete surface. Sawcut concrete, to a 1/2-inch depth, around the patch perimeter to prevent the repair mortar from feathering at the existing concrete surface.

6. Ensure repaired surface is smooth and free of bug holes, voids or other surface imperfections.

7. Extend Resurfacing and Spall Repair Patching Material with pea gravel as indicated on the Drawings and recommended by manufacturer.

8. Prepare repaired surface to provide a minimum surface profile of ICRI CSP5 or greater.

9. Apply and install Microbiologically Influenced Corrosion (MIC) coating system to the interior walls and underside of top slab, unless noted otherwise. Install the (MIC) coating where specifically defined in the Contract Drawings.

H. Waterproof Membrane Patch

1. Thoroughly clean and prepare the concrete substrate per manufacturer’s recommendations.

2. Apply waterproof membrane patch according to manufacturer's recommendations.

I. Cement Based Textured Coating

1. Thoroughly clean the concrete substrate and apply cement based textured coating according to manufacturer's recommendations.

2. Complete all necessary concrete repairs before applying coating.

J. Expansion Joint Repair

1. Thoroughly remove existing joint sealant and material within the joint to the waterstop.

2. Replace the joint material with material conforming to ASTM D1752 Types I thru IV.

3. Install a closed cell backer rod at a depth to allow for sealant.

4. Apply the sealant per the manufacturer’s recommendations.

5. Allow sealant to bond only to properly prepared concrete sides of expansion joint. The depth of the sealant is not to exceed one-half of the joint width.

3.5 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Field quality control tests, as specified in paragraph 1.6, unless otherwise stated, will be performed by a testing laboratory employed by the Owner.

2. Reimburse Owner for the cost of any additional tests and investigation on work

performed which does not initially meet the Specifications.

3. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification to be certified as a Concrete Field Testing Technician, Grade I, in accordance with ACI CP-2.
4. Testing laboratory is to conform to requirements of ASTM C1077.

B. Non-Conforming Work

1. Repair or replace unsatisfactory repair work discovered after it has been installed within 72 hours at no additional cost to the Owner.
2. This requirement applies for the entire guarantee period.

** END OF SECTION **

SECTION 03 60 00

GROUTING

1 GENERAL

1.1 SUMMARY

A. Scope

1. Furnish all labor, materials, equipment and incidentals required to install grout complete as shown on the Drawings and as specified herein.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C230 – Standard Specifications for Flow Table for Use in Tests of Hydraulic Cement
2. C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes
3. C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes
4. C621 – Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)
5. C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
6. C939 – Standard Test Method for Flow of Grout for Preplaced-aggregate Concrete (Flow Cone Method)
7. C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. U.S. Army Corps of Engineers Standard (CRD)

1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

A. Action Submittals/Informational Submittals

1. Product Data
   a. Data sheets for nonshrink cementitious grout and nonshrink epoxy grout to include:
      1) Catalog cut sheets.
      2) Technical data.
      3) Storage requirements.
      4) Product life.
      5) Working life time after mixing.
      6) Temperature considerations.
      7) Conformity to required ASTM standards.
      8) Material Safety Data Sheet
   b. Cement grout. Include the type and brand of the cement, the gradation of the fine aggregate, data on any proposed admixtures and the proposed mix of the grout.
2. Certificates
   a. Manufacturer’s Certificate of Compliance

1) Grout free from chlorides and other corrosion-causing chemicals.

2) Nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.

3) Certificate of Proper Installation.

b. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

3. Test and Evaluation Reports

a. Test results and service report from demonstration and training session.

b. Field test reports and laboratory test results for field-drawn samples.

4. Manufacturer's Instructions

a. Adding fiber reinforcing to batching.

b. Cement-water ratio of grout topping.

c. Mixing of grout.

5. Special Procedure Submittals

a. Proposed method for keeping existing concrete surfaces wet prior to placing grout.

b. Forming method for fluid grout placement.

c. Curing method for grout.

6. Qualification Statements

a. Documentation that manufacturer has at least 10 years' experience in the production and use of the proposed grouts which they will supply.

b. Statement of Qualification: Nonshrink grout manufacturer's representative.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

a. Have a minimum of 10 years' experience in the production and use of the type of grout proposed for the Work.

b. Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum 1-year direct personal experience that has resulted in the successful installation of grouts similar to those for this Project. Experience of the Manufacturer shall not be acceptable as a substitution for personal experience of the Representative.

B. Pre-installation Conference

1. A minimum of 14 days in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Notify parties concerned with grouting of the meeting at least 10 days prior to its scheduled date.

2. Have a qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, attend the pre-installation conference and be present for the initial installation of each type of nonshrink grout.

C. Field Samples

1. Owner will provide all field testing and inspection services required. Contractor shall assist in the sampling of materials and provide any ladders, platforms, etc., for access to the work. The methods of testing to comply in detail with the applicable ASTM Standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.
2. Deliver nonshrink cement-based grouts as preblended, prepackaged mixes requiring only the addition of water.
3. Deliver nonshrink epoxy grouts as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

B. Storage and Handling Requirements

1. Store materials in full compliance with the manufacturer's recommendations. Limit total storage time from date of manufacture to date of installation to 6 months or the manufacturer's recommended storage time, whichever is less.

1.6 WARRANTY

A. Manufacturer Warranty

1. Manufacturer’s warranty shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.
2. Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective as a result of faulty materials, as determined by industry standard test methods.

2 PRODUCTS

2.1 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired. Such reference is not intended to indicate a restrictive preference on the part of the County for that particular manufacturer or product, or to prohibit the use of equivalent products or equally qualified manufacturers.

B. Provide like materials as the products of one manufacturer or supplier in order to provide standardization of appearance.

2.2 GROUT SCHEDULE

A. General

1. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft by 3-ft and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
3. Nonshrink epoxy grout: Use for the setting of anchor rods and bolts, reinforcing steel in concrete, and for all locations specifically indicated to receive epoxy grout.
4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.
5. Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade.

B. Furnish nonshrink grout for applications in grout category in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40˚ F to 100˚ F	20 Min.	> 20 Min.
Filling tie holes	I	I	I
Blockouts for gate guides	I or II		II
Precast joints	I or II		II
Column baseplates single-story	I or II		II
Machine bases 25 HP or less	II	II	II
Precast base joints higher than one story	II	II	II
Through-bolt openings	II	II	II
Machine bases 26 HP and up	III	III	III
Baseplates and/or soleplates w/ vibration, thermal movement, etc.	III	III	III

2.3 MATERIALS

A. Nonshrink Cementitious Grout

1. Category I
   a. Nonmetallic and nongas-liberating.
   b. Prepackaged natural aggregate grout requiring only the addition of water.
   c. Test in accordance with ASTM C1107/C1107M:
      1) Grout to have flowable consistency.
      2) Flowable for 15 minutes.
   d. Exhibits no shrinkage when tested in accordance with ASTM C827.
   e. Does not bleed at maximum allowable water.
   f. Minimum strength of flowable grout: 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
   g. Manufacturers and Products
      1) Sika Corp., SikaGrout 212.
      2) Euclid Chemical Co., Euco NS.
      3) BASF Building Systems, Inc., Construction Grout.
      4) Dayton Superior Corp., 1107 Advantage Grout.
      5) L&M Construction Chemicals, Inc., Duragrout.
      6) Engineer approved equal.
2. Category II
   a. Nonmetallic and nongas-liberating.
   b. Prepackaged natural aggregate grout requiring only the addition of water.
   c. No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.
   d. Test in accordance with ASTM C1107/C1107M:
      1) Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
      2) Temperatures of 40 degrees F, 80 degrees F, and 100 degrees F.
   e. One hour after mixing, pass fluid grout through flow cone with continuous flow.
   f. Minimum strength of fluid grout: 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.

g. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready mix truck.

h. Manufacturers and Products

1) Sika Corp., SikaGrout 212.

2) Euclid Chemical Co., Hi-Flow Grout.

3) BASF Building Systems, Inc., Master Flow 928.

4) Dayton Superior Corp., Sure Grip High Performance Grout.

5) L&M Construction Chemicals, Inc., Crystex.

6) Engineer approved equal.

3. Category III

a. Metallic and nongas-liberating.

b. Prepackaged aggregate grout requiring only the addition of water.

c. No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.

d. Test in accordance with ASTM C1107/C1107M:

1) Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.

2) Temperatures of 40 degrees F and 100 degrees F.

e. One hour after mixing, pass fluid grout through flow cone with continuous flow.

f. Minimum strength of fluid grout: 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.

g. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready mix truck.

h. Manufacturers and Products

1) BASF Building Systems, Inc., EMBECO 885.

2) L&M Construction Chemicals, Inc., Ferrogrout.

3) Engineer approved equal.

B. Nonshrink Epoxy Grout

1. Three component, 100 percent solids, epoxy based grout consisting of epoxy resin, hardener, and blended aggregate.

2. Minimum Strength: 14,000 psi at 7 days when tested in conformity with ASTM D695.

3. Maximum Thermal Expansion: 30 x 10^{-6} when tested in conformity with ASTM C531.

4. Manufacturers and Products

a. Sika Corp., Sikadur 42 Grout-Pak.

b. Master Builders Inc., Ceilcote 648.

c. Euclid Chemical Co., High Strength Epoxy Grout.

d. U.S. Grout Corp., Five Star Epoxy Grout.

e. Engineer approved equal.

C. Cement Grout

1. Mixture of one part Portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. Sufficient water content to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Proportioned with cement, pozzalan (if approved by Engineer), coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an

average strength of 2,900 psi at 28 days, or 2,500 psi nominal strength.

2. Maximum ½-inch coarse aggregate size.
3. Slump: As low as practical yet still retain sufficient workability. Maximum 5 inches.
4. Add synthetic reinforcing fibers to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

3 EXECUTION

3.1 PREPARATION

A. Place grout over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.

B. Prepare concrete surfaces to receive grout to be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Use oilless air compressors to clean surfaces in contact with grout or equip them with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Wash concrete surfaces clean and keep moist for at least 24 hours prior to the placement of cementitious or cement grout. Achieve saturation by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, remove visible water from the surface prior to grouting. When approved by the Engineer for each specific location of grout installation, an adhesive bonding agent may be used in lieu of surface saturation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Completely dry surfaces in contact with epoxy grout prior to placing grout.

G. Construct grout forms or other leakproof containment as required. Line or coat forms with release agents recommended by the grout manufacturer. Provide forms of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

1. Design forms for epoxy grout to allow the formation of a hydraulic head and provide chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Support equipment during alignment and installation of grout by shims, wedges, blocks or other approved means. Prevent the shims, wedges and blocking devices from bonding to the grout by appropriate bond breaking coatings. Remove after grouting unless otherwise approved by the Engineer.

3.2 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and

placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.3 INSTALLATION – CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. When approved by the manufacturer, include the addition of clean, washed pea gravel to the grout mix for placements greater than 3 inches in depth. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.4 INSTALLATION – NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not over mix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Use placement methods which ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.5 INSTALLATION – CONCRETE GROUT

A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the slab using a strong jet of water. Flushing of debris into drain lines will not be permitted.

C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste. A bonding grout composed of 1 part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.

D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, do not use mechanical scraper mechanisms as a finishing machine or screed.

E. Provide grout control joints as indicated on the Drawings.

F. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.6 FIELD QUALITY CONTROL

A. Evaluation and Acceptance of Grout

1. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer’s representative.

2. For each 25 cubic feet of each type of grout used perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes. Use restraining caps for cube molds in accordance with ASTM C1107/C1107M.

3. Consistency: As specified in paragraph 2.3, above. Reject grout with consistencies outside range requirements.

4. Segregation: As specified in paragraph 2.3, above. Reject grout if aggregate separates.

5. Grout cubes shall test equal to or greater than minimum strength specified.

6. Strength Test Failures: Remove and replace grout work failing strength tests.

7. Perform bleeding test to demonstrate grout will not bleed.

8. Store cubes at 70 degrees F.

9. Owner’s independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.

3.7 MANUFACTURER’S SERVICES

A. General

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout

manufacturer's representative.

2. Provide and conduct onsite demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of grout.
3. Make the necessary equipment and materials available for demonstrations.

B. Training

1. Training is required for all Type II and Type III nonshrink cementitious and nonshrink epoxy grout installations.
2. Grout manufacturer's representative shall train Contractor to perform grout work.
3. Establish location at Site and schedule time for grout manufacturer's demonstration and training session of proposed nonshrink grouts. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and tie holes to provide actual on-the-job training.
4. Use minimum of five bags for each nonshrink grout type and category. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.
5. Include methods for curing grout in training sessions.
6. Mix and demonstrate patching through-bolt holes and blockouts for gate guides, and similar items.

** END OF SECTION **

SECTION 05 57 00

MISCELLANEOUS METALS

1 GENERAL

1.1 SUMMARY

A. Scope

1. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.2 REFERENCES

A. Reference Standards

1. Aluminum Association (AA)

a. AA M31C22A41

1) M31: Mechanical Finish, Fine Satin

2) C22: Finish, Medium Matte

3) A41: Clear Anodic Coating, Class I

2. American Society for Testing and Materials (ASTM)

a. A36 - Standard Specification for Carbon Structural Steel

b. A48 - Standard Specification for Gray Iron Castings

c. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

d. A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality

e. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

f. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

g. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

h. A276 - Standard Specification for Stainless Steel Steel Bars and Shapes

i. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength

j. A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

k. A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

l. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

m. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

n. A536 – Standard Specification for Ductile Iron Castings

o. A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

p. B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

q. B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars,

Rods, Wire, Profiles and Tubes

r. B429 – Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

3. American Iron and Steel Institute (AISI)
   a. Specification for Structural Steel Buildings
4. American Welding Society (AWS)
   a. AWS D1.1 – Structural Welding Code Steel
   b. AWS D1.2 – Structural Welding Code Aluminum
5. Federal Specifications
   a. FS-FF-B-575C – Bolts, Hexagonal and Square
6. Occupational Safety and Health Administration (OSHA)
7. International Building Code (IBC)
8. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

A. Action Submittals/Informational Submittals
   1. Product Data
      a. Provide material data sheets for all metals provided under this section including material properties, production methods, etc.
   2. Shop Drawings
      a. Provide drawings, showing sizes of members, method of assembly, anchorage and connection to other members.
   3. Certificates
      a. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.
      b. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer with description of material processed and ASTM standard used for coating.
   4. Delegated Design Submittals
      a. Provide design calculations signed and sealed by a professional engineer registered in the State of Georgia for all fabricated structural supports, assemblies, and systems provided under this section.
   5. Test and Evaluation Reports
      a. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

1.4 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. Qualifications
   1. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual for the American Galvanizers Association.
   2. All welding shall be performed by qualified welders and shall conform to the applicable

AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble items specified herein. Assemblies that due to necessity have to be shipped unassembled shall be packaged and tagged in a manner that will protect materials from damage and will facilitate identification and field assembly.

B. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

C. Package stainless steel items in a manner to provide protection from carbon impregnation.

D. Protect painted coatings and hot-dip galvanized finishes from damage due to metal banding and rough handling. Use padded slings and straps.

E. Store fabricated items in dry area, not in direct contact with ground.

F. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.6 FIELD CONDITIONS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

2 PRODUCTS

2.1 GENERAL

A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for A36 steel), limit the maximum silicon content to 0.21 percent and the phosphorous content to 0.03 percent.

B. Form all miscellaneous metal work true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Provide smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

C. Provide connections and accessories of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Conceal threads where practical for threaded connections. Provide continuous welds or intermittent welds as specified or shown for welded connections. Dress flush and smooth the face of welds. For aluminum items, perform welding on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

D. Unless otherwise indicated, meet the following requirements:

Item	**ASTM Reference**
Steel Shapes and Plates, unless otherwise noted	A36/A36M
Wide Flange Shapes including WT Sections	A992
Steel Pipe	A501 or A53/A53M, Type E or S, Grade B
Structural Steel Tubing	A500, Grade B
Stainless Steel	
Bars, Angles and Shapes	A276, AISI Type 316 (316L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for

	welded connections)
Aluminum Plates and Structural Shapes	B209 and B308/B308M, Alloy 6061-T6
Cast Iron	A48, Class 35

2.2 STEEL SHELF ANGLES

A. ASTM A36/A36M hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

2.3 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete to be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Provide stainless steel welded anchors for stainless steel support frames.

2.4 U-CHANNEL CONCRETE INSERTS

A. Rolled ASTM A240/A240M AISI Type 316 stainless steel, 0.105-inch thickness, 1-5/8-inch width by 1-3/8-inch depth, with stainless steel anchors at 10-inch maximum spacing, Styrofoam fillers and end caps.

B. Nut and Bolt Hardware: Type 316 stainless steel, 5/8-inch minimum diameter, unless indicated otherwise. Manufacturer's standard to match insert.

C. Manufacturers and Products

1. Power Strut – PS 349 Series.
2. B-Line Systems, Inc. – B32 Series.
3. Halfen Anchoring Systems – Channel Type 4141HTA.
4. Engineer approved equal.

2.5 FLOOR PLATE

A. Material

1. Galvanized Steel: Carbon Steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
2. Stainless Steel: ASTM A793, AISI Type 304.
3. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

B. Minimum Thickness

1. Steel: ¼-inch, unless shown otherwise on Drawings.
2. Aluminum: 3/8-inch, unless shown otherwise on Drawings.

C. Provide raised-lug pattern or diamond tread surface, unless shown otherwise on Drawings.

D. Provide slip-resistant surface where indicated on Drawings.

2.6 EXTRUDED FLOOR PLATE

A. Extruded Deck Plate

1. Minimum Section Height: As shown on Drawings.
2. Minimum Section Width: 12 inches.
3. Accessories: Dovetail interlock strips. Anchor clamp fixtures, toe board, 1-inch raised lip.

B. Extruded Tread Plate

1. Minimum Section Height: 0.360-inch, plus serrations.
2. Minimum Section Width: 12 inches.
3. Accessories: Edgebands, tongue-and-groove attachments.

2.7 MISCELLANEOUS ALUMINUM

A. Miscellaneous aluminum items include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

B. Provide welded strap anchors on angle frames for hatches, beams, grates, etc.

C. Provide clean and degreased mill finish for miscellaneous aluminum items.

2.8 MISCELLANEOUS STEEL AND STAINLESS STEEL

A. Miscellaneous steel items include: beams, angles, lintels, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

B. Miscellaneous stainless steel items include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

C. Shop coat with primer structural steel angle and channel door frames. Fabricate frames fabricated with not less than three anchors on each jamb.

D. Provide Schedule 40 pipe for steel pipe pieces for sleeves, lifting attachments and other functions unless otherwise shown on the Drawings. Provide welded circumferential steel waterstops at mid-length on wall and floor sleeves, of steel pipe.

E. Shop coat with primer lintels, relief angles or other steel supporting masonry or embedded in masonry.

F. Thoroughly clean all steel finish work of all loose mill scale, rust and foreign matter and give one shop coat of primer compatible with the finish coat after fabrication but before shipment. Omit paint within 3 inches of proposed field welds. Apply paint to dry surfaces. Thoroughly and evenly spread paint and work into joints and other open spaces.

G. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.9 ACCESSORIES

A. Neoprene Gaskets

1. ASTM D1056, 2Cl, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
2. Thickness: Minimum ¼-inch.
3. Furnish without skin coat.

2.10 FABRICATION

A. General

1. Finish exposed surfaces smooth, sharp, and to well defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or between 0.15 and 0.25 percent.

3. Fabricate aluminum in accordance with AA Specification for Aluminum Structures – Allowable Stress Design.

C. Welding

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications to be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1, Section 5.
4. Aluminum: Meet requirements of AWS D1.2.
5. Stainless Steel: Meet Requirements of AWS D1.6.
6. Complete welding before applying finish.

D. Painting

1. Shop prime with rust-inhibitive primer as specified in Section 09 91 00 – Painting, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 91 00 – Painting, unless otherwise indicated.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless otherwise indicated.

E. Galvanizing

1. Fabricate steel to be galvanized in accordance with ASTM A143, ASTM A384, and ASTM A385. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM 123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanize steel sheets in accordance with ASTM A653.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Watertight Seal: Where required or shown, furnish neoprene gaskets. Cover full bearing surfaces.

G. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

H. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.11 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct any deficiencies.

1. Steel: AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.

2. Aluminum: AWS D1.2.
3. Stainless Steel: AWS D1.6

B. Hot-Dip Galvanizing

1. An independent testing agency will be retained by Owner to inspect and test hot-dip galvanized fabricated items in accordance with ASTM A123/A123M and ASTM A153/A153M.
2. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123/A123M and ASTM A153/A153M.
3. Reject and retest nonconforming articles in accordance with ASTM A123/A123M and ASTM A153/A153M.

3 EXECUTION

3.1 INSTALLATION OF METAL FABRICATIONS

A. General

1. Install metal fabrications plumb or level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufacturer products in accordance with manufacturer's recommendations.
4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum

1. Do not remove mill markings from concealed surfaces.
2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
3. Provide fabrication, mechanical connections, and welded construction in accordance with the AA Aluminum Design Manual.

C. U-Channel Concrete Inserts

1. Provide as indicated for pipe supports and where otherwise shown on Drawings.
2. Except for interior dry areas, use plastic clips or similar dielectric material to isolate channel anchors from concrete reinforcing steel.

3.2 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel

1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 91 00 – Painting, unless indicated otherwise.
2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless otherwise indicated.
3. Allow coating to dry before installation of the material.
4. Protect coated surfaces during installation.
5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Stainless Steel

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil,

paint, and other forms of contamination.

3. Remove contamination in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect all surfaces for compliance.

3.3 PAINTING AND REPAIR OF GALVANIZED STEEL

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 91 00 – Painting.

B. Repair of Damaged Hot-Dip Galvanized Coating

1. Conform to ASTM A780.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
4. Use magnetic gauge to determine thickness is equal to or greater than the base galvanized coating.

** END OF SECTION **

SECTION 09 90 00
PAINTING

1 GENERAL

1.1 DESCRIPTION

A. The work covered by this section includes furnishing all labor, materials, and equipment required to accomplish all painting as specified herein and shown on the Drawings.

1.2 SCOPE OF WORK

A. In general, work included under this section shall include the surface preparation, shop priming, field priming, and/or field painting of all exposed items and surfaces throughout the project, unless otherwise indicated.

B. All exposed items and surfaces shall be painted using the appropriate coating system as specified herein. Coating system schedules and finish schedules may be provided herein and/or on the Drawings, which identify specific paint systems and paint colors to be used on specific items and surfaces. However, these schedules do not necessarily cover all items to be painted. Where the selection of a specific painting system for a particular application is not clear, it shall be the responsibility of the Contractor to request clarification from the Engineer.

C. Surface preparation, priming, and coats of paint specified are in addition to shop priming and surface pretreatment specified in other sections, unless otherwise indicated.

D. All exposed surfaces shall be painted except where the natural finish of the material is obviously intended to be the finished surface or if the surface is specifically noted not to be painted.

E. In general, items to be painted include:

1. All exposed exterior surfaces including:
    a. Concrete block.
    b. Equipment supports.
    c. Pipe, valves, fittings, hydrants, and appurtenances.
    d. Ductwork and appurtenances.
    e. Non-galvanized conduit and appurtenances.
    f. Ferrous metals.
    g. All factory primed steel doors and equipment.
    h. Exposed untreated wood.
    i. All other surfaces subject to corrosion.
2. All exposed interior surfaces including:
    a. All wall surfaces in all spaces unless specifically noted not to be painted.
    b. All columns, equipment pads, pipe supports, and appurtenances.
    c. Pipe, valves, fittings, hydrants, and appurtenances.
    d. Ductwork and appurtenances.
    e. All electrical conduit unless specifically noted not to be painted.
    f. All hangers and supports for overhead items.
    g. Ferrous metals.
    h. All factory primed steel doors and equipment.
    i. Exposed untreated wood.

j. All other surfaces subject to corrosion.

3. Equipment that does not have an approved final coat or does not have the appropriate finished color as directed by the Engineer.
4. Touch up all equipment that has been damaged by the existing construction as directed by the Engineer.
5. Touch up all existing or new items and surfaces damaged by construction as directed by the Engineer.

F. In general, items NOT to be painted include:

1. Items with Engineer approved factory finish.
2. Electrical equipment unless specifically noted.
3. Surfaces hidden from view including piping, conduit, ducts, and insulation. Note, the manufacturer's standard coatings, if any, may remain.
4. Stainless steel surfaces except piping or tubing.
5. Aluminum surfaces except:
   a. Where specifically noted to be painted.
   b. Where embedded in or in contact with concrete.
   c. Where in contact with dissimilar metals.
   d. Piping or tubing.
6. Fiberglass surfaces except piping and piping appurtenances.
7. Interior of pipe, ductwork, and conduits.
8. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.
9. Code labels and equipment identification and rating plates.
10. Exterior concrete or pre-cast concrete surfaces.
11. Galvanized metal surfaces except interior conduit.
12. Face brick, ceramic tile, plastic laminate.
13. Concealed deck except where specifically specified to be painted.
14. Pre-finished metal.
15. Interior and exterior of concrete basins, vaults, and tanks unless noted otherwise.

1.3 DEFINITIONS

A. Definitions of Painting Terms: ASTM D16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.4 SUBMITTALS

A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of the section titled "Submittals" of these specifications.

B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:

1. Product Data
   a. Submit Manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
2. Color Samples
   a. Submit Manufacturer's color samples showing full range of standard colors.

C. Manufacturer's Quality Assurance

1. Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

D. Warranty

a. Submit a complete description of the warranty to be provided.

E. Painting Schedule

1. Contractor shall submit a schedule of all items (structures, equipment, pipe, etc.) to be painted prior to beginning painting operations. Schedule shall include, but not be limited to, items to be painted, surface preparation, paint system, and color. The schedule shall be submitted to the Engineer for approval at which time the Engineer will select the colors to be used that are not specified herein or on the Drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility

a. Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this work.
2. Applicator's Personnel

a. Employ persons trained for application of specified coatings.

C. Pre-application Meeting

1. Convene a pre-application meeting two weeks before start of application of coating systems. Attendance of parties directly affecting work of this section, including Contractor, Engineer, Applicator, and Manufacturer's representative, is required. The meeting shall cover, but not be limited to, the following:

a. Environmental requirements.

b. Protection of surfaces not scheduled to be coated.

c. Surface preparation.

d. Application.

e. Repair.

f. Field quality control.

g. Cleaning.

h. Protection of coating systems.

i. One-year inspection.

j. Coordination with other work.

D. Manufacturer's Representative During Painting Operations

1. An authorized Manufacturer's representative shall be present at the start-up and weekly during painting operations. Such representative shall instruct and observe the Contractor's and Applicator's work and shall, at the completion of work, certify in writing to the Engineer that the Manufacturer's application recommendations have been adhered to. The cost of this work shall be borne by the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

a. Coating or material name.

b. Manufacturer.

c. Color name and number.

d. Batch or lot number.

e. Date of manufacture.

f. Mixing and thinning instructions.

B. Storage

1. Store materials in a clean dry area and within temperature range in accordance with Manufacturer's instructions.

2. Keep containers sealed until ready for use.

3. Do not use materials beyond Manufacturer’s shelf life limits.

C. Handling

1. Protect materials during handling and application to prevent damage or contamination.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Weather

1. Air and Surface Temperatures

a. Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer’s instructions.

2. Surface Temperature

a. Minimum of 5 °F (3 °C) above dew point.

3. Relative Humidity

a. Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer’s instructions.

4. Precipitation

a. Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.

5. Wind

a. Do not spray coatings if wind velocity is above manufacturer’s limit.

B. Ventilation

1. Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.

C. Dust and Contaminants

1. Schedule coating work to avoid excessive dust and airborne contaminants.

2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.8 TESTING EQUIPMENT

A. The Contractor shall furnish and make available to the Engineer the following items of testing equipment for use in determining if requirements of this section are being satisfied. Specified items of equipment shall be available for the Engineer’s use at all times when field painting or surface preparation is in progress.

a. Wet film gauge.
b. Surface thermometer.
c. Keane-Tator surface profile comparator.
d. Set of National Association of Corrosion Engineers (NACE) visual standards.
e. Holiday (pin hole) detector (low voltage).
f. Sling-psychrometer.
g. Magnetic dry film gauge.

2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers include:
1. Tnemec.
2. Induron.
3. Carboline.

B. Unless otherwise indicated, product names and numbers specified herein are manufactured by Tnemec. Equivalent materials produced by approved Manufacturer's shall be acceptable subject to prior review by the Engineer.

2.2 COATING SYSTEMS

A. General
1. Tnemec product names and numbers are specified herein. Equivalent materials produced by approved manufacturers shall be acceptable.
2. Exposure terms refer to the environmental conditions to which different surfaces may be exposed. A surface may exist in more than one exposure, e.g. an exterior wall can be categorized not only as "Exposed", but also as "Buried", where the exposure is below the grade line.

B. Coating Systems
1. Structural Steel – Interior Exposed
a. System Type: Epoxy/Epoxy
b. Surface Preparation: SSPC-SP6/NACE 3
c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
e. Total DFT: 6 to 10 mils
2. Structural Steel – Exterior Exposed
a. System Type: Epoxy/Polyurethane
b. Surface Preparation: SSPC-SP6/NACE 3
c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
d. Intermediate Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
e. Finish Coat: TNEMEC Series 1074 Endura-Shield, 2 to 5 mils DFT
f. Total DFT: 7 to 13 mils
3. Structural Steel – Below Grade (Buried) and Immersed
a. System Type: Epoxy/Coal Tar Epoxy
b. Surface Preparation: SSPC-SP10/NACE 2

c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
d. Finish Coat: TNEMEC Series 46H-413 Hi-Build Tneme-Tar, 14 to 20 mils DFT
e. Total DFT: 17 to 25 mils

4. Structural Steel – Interior/Immersion Severe H_2S Exposure (Inside Pump Station Wet Wells)
   a. System Type: Modified Polyamine Epoxy
   b. Surface Preparation: SSPC-SP5/NACE 1
   c. Prime Coat: TNEMEC Series 435 Perma-Glaze, 15 to 20 mils DFT
   d. Finish Coat: TNEMEC Series 435 Perma-Glaze, 15 to 20 mils DFT
   e. Total DFT: 30 to 40 mils
5. Factory Primed Steel Doors, Frames, and Equipment – Interior Exposed
   a. System Type: Epoxy/Epoxy
   b. Surface Preparation: Clean and Dry
   c. Prime Coat: Factory Primed
   d. Intermediate Coat: TNEMEC Series 27 F.C. Typoxy, 2 to 3 mils DFT
   e. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
   f. Total DFT: 4 to 6 mils
6. Factory Primed Steel Doors, Frames, and Equipment – Exterior Exposed
   a. System Type: Epoxy/Polyurethane
   b. Surface Preparation: Clean and Dry
   c. Prime Coat: Factory Primed
   d. Intermediate Coat: TNEMEC Series 27 F.C. Typoxy, 2 to 3 mils DFT
   e. Finish Coat: TNEMEC Series 1075 Endura-Shield II, 2 to 3 mils DFT
   f. Total DFT: 4 to 6 mils
7. Galvanized Steel Pipe and Non-Ferrous Metal Pipe – Interior Exposed
   a. System Type: Epoxy/Epoxy
   b. Surface Preparation: Per manufacturer’s recommendation
   c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
   d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
   e. Total DFT: 4 to 6 mils
8. Galvanized Steel Pipe and Non-Ferrous Metal Pipe – Exterior Exposed
   a. System Type: Epoxy/Polyurethane
   b. Surface Preparation: Per manufacturer’s recommendation
   c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
   d. Finish Coat: TNEMEC Series 1075 Endura-Shield II, 2 to 3 mils DFT
   e. Total DFT: 4 to 6 mils
9. Galvanized Steel Pipe and Non-Ferrous Metal Pipe – Immersed
   a. System Type: Epoxy/Epoxy
   b. Surface Preparation: Per manufacturer’s recommendation
   c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
   d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT

e. Total DFT: 7 to 11 mils

10. Ductile Iron Pipe, Pumps, and Valves – Interior Exposed
    a. System Type: Epoxy/Epoxy
    b. Surface Preparation: Per manufacturer's recommendation
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
    d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    e. Total DFT: 7 to 11 mils
11. Ductile Iron Pipe, Pumps, and Valves – Exterior Exposed
    a. System Type: Epoxy/Epoxy/Polyurethane
    b. Surface Preparation: Per manufacturer's recommendation
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
    d. Intermediate Coat: TNEMEC Series 69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    e. Finish Coat: TNEMEC Series 1075 Endura-Shield II, 2 to 3 mils DFT
    f. Total DFT: 9 to 14 mils
12. Ductile Iron Pipe, Pumps, and Valves – Below Grade (Buried) and Immersed
    a. System Type: Epoxy/Coal Tar Epoxy
    b. Surface Preparation: Per manufacturer's recommendation
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 3 to 5 mils DFT
    d. Finish Coat: TNEMEC Series 46H-413 Hi-Build Tneme-Tar, 14 to 20 mils DFT
    e. Total DFT: 17 to 25 mils
13. Ductile Iron Pipe, Pumps, and Valves – Interior/Immersion Severe H_2S Exposure (Inside Pump Station Wet Wells)
    a. System Type: Ceramic-Filled Epoxy
    b. Surface Preparation: Per manufacturer's recommendation
    c. Prime Coat: TNEMEC Series N140 Pota-Pox Plus, 3 to 5 mils DFT
    d. Finish Coat: TNEMEC Series 431 Perma-Shield PL, 30 to 40 mils DFT
    e. Total DFT: 33 to 45 mils
14. Polyvinyl Chloride – Interior Exposed
    a. System Type: Epoxy/Epoxy
    b. Surface Preparation: Scarify
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
    d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
    e. Total DFT: 4 to 6 mils
15. Polyvinyl Chloride – Exterior Exposed
    a. System Type: Epoxy/Polyurethane
    b. Surface Preparation: Per manufacturer's recommendation
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT
    d. Finish Coat: TNEMEC Series 1075 Endura-Shield II, 2 to 3 mils DFT
    e. Total DFT: 4 to 6 mils
16. Insulated Pipe – Interior/Exterior Exposed
    a. System Type: Acrylic/Acrylic

b. Surface Preparation: Clean and Dry
c. Prime Coat: TNEMEC Series 1029 Enduratone (semi-gloss), 2 to 3 mils DFT
d. Finish Coat: TNEMEC Series 1029 Enduratone (semi-gloss), 2 to 3 mils DFT
e. Total DFT: 4 to 6 mils

17. Cast-In-Place and Precast Concrete – Interior Exposed
    a. System Type: Epoxy/Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 2-4, concrete cured a minimum of 28 days
    c. Prime Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    d. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    e. Total DFT: 8 to 12 mils
18. Cast-In-Place and Precast Concrete – Exterior Exposed
    a. System Type: Waterborne Acrylate/Waterborne Acrylate
    b. Surface Preparation: SSPC-SP13/NACE 6, clean and dry, concrete cured a minimum of 28 days
    c. Prime Coat: TNEMEC Series 156 Enviro-Crete, 4 to 8 mils DFT
    d. Finish Coat: TNEMEC Series 156 Enviro-Crete, 4 to 8 mils DFT
    e. Total DFT: 8 to 16 mils
19. Cast-In-Place and Precast Concrete – Below Grade
    a. System Type: Coal Tar Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 3, concrete cured a minimum of 28 days
    c. Finish Coat: TNEMEC Series 46H-413 Hi-Build Tneme-Tar, 14 to 20 mils DFT
    d. Total DFT: 14 to 20 mils
20. Cast-In-Place and Precast Concrete – Interior/Immersion Severe H_2S Exposure (Inside Pump Station Wet Wells)
    a. System Type: Modified Polyamine Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 5, concrete cured a minimum of 28 days
    c. Filler: TNEMEC Series 217 MortarCrete, fill voids
    d. Prime Coat: TNEMEC Series 434 Perma-Shield H_2S, 125 mils DFT
    e. Finish Coat: TNEMEC Series 435 Perma-Glaze, 15 to 20 mils DFT
    f. Total DFT: Nominal 125 mils
21. Concrete Floors – Light Traffic, Low Impact
    a. System Type: Waterborne Epoxy/Waterborne Acrylic
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 1-3
    c. Prime Coat: TNEMEC Series 287 Enviro-Pox, 3 to 4 mils DFT
    d. Finish Coat: TNEMEC Series 287 Enviro-Pox, 3 to 4 mils DFT
    e. Total DFT: 6 to 8 mils
22. Concrete – Secondary Containment
    a. System Type: Epoxy/Epoxy/Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 3-9

c. Prime Coat: TNEMEC Series 201 Epoxoprime, 6 to 8 mils DFT
d. Intermediate Coat: TNEMEC Series 239SC ChemTread, 68 to 92 mils DFT
e. Finish Coat: TNEMEC Series 282 Tneme-Glaze, 6 to 8 mils DFT
f. Total DFT: Nominal 125 mils

23. Concrete Masonry Unit (CMU) – Interior Exposed
    a. System Type: Epoxy/Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 2-4, CMU clean and dry
    c. Prime Coat: TNEMEC Series 130 Envirofill, 60 to 80 square feet per gallon
    d. Intermediate Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    e. Finish Coat: TNEMEC Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT
    f. Total DFT: 8 to 12 mils
24. Concrete Masonry Unit (CMU) – Exterior Exposed
    a. System Type: Acrylate/Acrylate
    b. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 2-4, CMU clean and dry
    c. Prime Coat: TNEMEC Series 130 Envirofill, 60 to 80 square feet per gallon
    d. Intermediate Coat: TNEMEC Series 156 Enviro-Crete, 4 to 8 mils DFT
    e. Finish Coat: TNEMEC Series 156 Enviro-Crete, 4 to 8 mils DFT
    f. Total DFT: 8 to 16 mils
25. Plaster and Gypsum Wallboard
    a. System Type: Waterborne Epoxy/Waterborne Acrylic
    b. Surface Preparation: Clean and Dry
    c. Prime Coat: TNEMEC Series 151-1051 Elasto-Grip FC, 1 to 2 mils DFT
    d. Finish Coat: TNEMEC Series 113 H.B. Tneme-Tufcoat, 4 to 6 mils DFT
    e. Total DFT: 5 to 8 mils
26. Wood – Interior or Exterior Exposed
    a. System Type: Alkyd/Acrylic
    b. Surface Preparation: Sand, Clean and Dry
    c. Prime Coat: TNEMEC Series 10-99W Tnemec Primer, 2 to 3.5 mils DFT
    d. Finish Coat: TNEMEC Series 1029 Enduratone (semi-gloss), 2 to 3 mils DFT
    e. Total DFT: 4 to 6.5 mils
27. Concrete Floors – Severe Chemical
    a. System Type: Epoxy
    b. Surface Preparation: SSPC-SP13/NACE 6, followed by abrasive blast
    c. Prime Coat: Series 201 Epoxoprime, 6 to 12 mils DFT
    d. Intermediate Coat: Series 282 Tneme-Glaze, 6 to 12 mils DFT
    e. Finish Coat: Series 280 Tneme-Glaze, 6 to 12 mils DFT
    f. Total DFT: 18 to 36 mils
    g. Spread sand over prime coat to create rough surface.

2.3 ACCESSORIES

A. Coating Application Accessories

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF STEEL

A. Prepare steel surfaces in accordance with Manufacturer's instructions.

B. Fabrication Defects

1. Correct steel and fabrication defects revealed by surface preparation.
2. Remove weld spatter and slag.
3. Round sharp edges and corners of welds to a smooth contour.
4. Smooth weld undercuts and recesses.
5. Grind down porous welds to pinhole-free metal.
6. Remove weld flux from surface.

C. Ensure surfaces are dry.

D. Immersed or Below Grade Surfaces

1. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 10/NACE 2.

E. Exterior Exposed or Interior Exposed Surfaces

1. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.

F. Interior or Immersed Surfaces, Severe Atmospheres

1. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 5/NACE 1.

G. Abrasive Blast-Cleaned Surfaces

1. Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

H. Shop Primer

1. Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

3.4 SURFACE PREPARATION OF GALVANIZED STEEL AND NONFERROUS METAL

A. Prepare galvanized steel and nonferrous metal surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are dry.

C. Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or Manufacturer's instructions as specified for coating system.

D. Immersed Service

1. Clean surfaces by abrasive blasting.

E. Remove Rust From Galvanized Steel

1. Remove white rust from galvanized steel by hand or power brushing.
2. Remove rust from old galvanized steel in accordance with SSPC-SP 2 or SP 3.
3. Do not damage or remove galvanizing.

F. Increase mechanical adhesion under moderate to severe conditions, such as exterior exposure or chemical environments, by abrasive blast and/or chemical cleaning.

3.5 SURFACE PREPARATION OF DUCTILE OR CAST IRON

A. Prepare ductile or cast iron surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.6 SURFACE PREPARATION OF PVC

A. Prepare PVC surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Scarify PVC surfaces.

3.7 SURFACE PREPARATION OF INSULATED PIPE

A. Prepare insulated pipe surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.8 SURFACE PREPARATION OF CONCRETE

A. Interior, Exposed

1. Prepare concrete surfaces in accordance with Manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
2. Allow concrete to cure for a minimum of 28 days.
3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
4. Abrasive blast surface to remove laitance and solid contaminants and to provide clean, sound substrate with uniform anchor profile.
5. Fill holes, pits, voids, and cracks with Tnemec 63-1500 Filler and Surfacer.
6. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

B. Exterior

1. Prepare concrete surfaces in accordance with Manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
2. Allow concrete to cure for a minimum of 14 days.
3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
4. Level concrete protrusions and mortar spatter.
5. Fill hairline cracks less than 1/64 inch (0.4 mm) in accordance with Manufacturer's instructions.
6. Prepare cracks wider than 1/64 inch (0.4 mm), moving cracks, gaps, and expansion joints in accordance with Manufacturer's instructions.
7. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

3.9 SURFACE PREPARATION OF CONCRETE FLOORS

A. Prepare concrete surfaces in accordance with Manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Allow concrete to cure for a minimum of 28 days before coating.

D. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

3.10 SURFACE PREPARATION OF SECONDARY CONTAINMENT

A. Prepare secondary containment surfaces in accordance with Manufacturer's instructions.

B. Prepare concrete surfaces in accordance with Manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.

C. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

D. Allow concrete to cure for a minimum of 28 days before coating.

E. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

3.11 SURFACE PREPARATION OF POROUS CONCRETE MASONRY UNITS

A. Prepare porous concrete masonry unit surfaces in accordance with Manufacturer's instructions and SSPC-SP 13/NACE 6.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Allow mortar to cure for a minimum of 28 days before coating.

D. Level protrusions and mortar spatter.

3.12 SURFACE PREPARATION OF PLASTER

A. Prepare plaster surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Allow plaster to cure and dry out for a minimum of 28 days before coating.

D. Do not coat over plaster containing free water, lime, or other soluble alkaline salts.

E. Remove plaster nibs and other protrusions.

F. Patch voids and cracks with approved materials and after dry, sand flush with surface.

3.13 SURFACE PREPARATION OF GYPSUM BOARD

A. Prepare gypsum board surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Sand joint compound smooth and feather edge.

D. Avoid heavy sanding of adjacent gypsum board surfaces, which will raise nap of paper covering.

E. Do not apply putty, patching pencils, caulking, or masking tape to drywall surfaces to be painted.

F. Lightly scuff-sand tape joints after priming to remove raised paper nap. Do not sand through primer.

3.14 SURFACE PREPARATION OF WOOD

A. Prepare wood surfaces in accordance with Manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, surface deposits of sap or pitch, and other contaminants.

C. Seal knots and pitch pockets.

D. Sand rough spots with the grain.

E. Fill cracks and holes with approved materials after primer is dry. Sand flush with surface when filler is hard.

F. Lightly sand between coats.

3.15 APPLICATION

A. Apply coatings in accordance with Manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with Manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.16 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated

1. Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings

1. Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects

1. Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.17 FIELD QUALITY CONTROL

A. Applicator's Services

1. Verify coatings and other materials are as specified.

2. Verify surface preparation and application are as specified.

3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.

4. Coating Defects

a. Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

b. Check for holidays on interior steel immersion surfaces using holiday detector.

5. Report

a. Submit daily written reports describing work performed, inspections made, and actions taken to correct nonconforming work. Daily reports shall contain, but not be limited to, the following information:

1) Start date and time of work in each area.

2) Weather conditions.

3) Date and time of application for each following coat.

4) Moisture content of substrate prior to each coat.

5) Provisions utilized to maintain temperature and humidity of work area with Manufacturer's recommended ranges.

b. Report nonconforming work not corrected.

c. Submit copies of report to Engineer and Contractor.

B. Manufacturer's Field Services

1. Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems and shall be available per paragraph 1.5.E.

3.18 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.19 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.20 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Engineer, and Manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Engineer in accordance with Manufacturers instructions.

3.21 PIPE CODING

A. All process piping shall be color-coded. Pipe color and band color, when required, shall be in accordance with the Color Schedule of this section.

B. Bands shall be spaced at maximum 6 feet on center. On pipe runs less than 6 feet in length, one band shall be located at the center of the run.

1. Place bands:

a. Along continuous lines.

b. At changes in direction.

c. At changes in elevation.

d. On both sides of an obstruction.

2. Band width shall be as follows:

a. For pipes up to 8" in diameter: 2" minimum.

b. For pipes 10" to 24" in diameter: 4" minimum.

c. For pipes 30" to 48" in diameter: 6" minimum.

d. For pipes greater than 48" in diameter: 8" minimum.

C. Pipe Labels

1. After painting of pipe work is completed, all pipe work shall have stenciled labels indicating the contents of the pipe (i.e. "RAW WASTEWATER").

2. Labels shall be placed on each side of the pipe (180 degrees from each other) and spaced at maximum 20 feet on center. Labels shall be placed such that they are in direct line of site. For pipe runs less than 20 feet, label shall be placed at the center of the run or the most visible location. Label may be omitted from one side of pipe if view is obstructed from that side.

3. When the flow in a pipe is in one direction at all times, flow direction arrows shall be placed in front of each label on the pipe.

4. The width of each letter shall be 80% of the height of each letter. The height of each letter shall be as follows:

a. For pipes ¾" to 1½" in diameter: ½" in height.

b. For pipes 2" in diameter: ¾" in height.

c. For pipes 2½" to 6" in diameter: 1¼" in height.

d. For pipes 6" to 10" in diameter: 2½" in height.

e. For pipes greater than 10" in diameter: 3½" in height.

5. For pipes smaller than ¾" in outside diameter, use a laminated plastic or aluminum tag with the lettering etched or stamped and filled in with black or contrasting enamel.

6. Labels shall be black or white in color such that it is contrasting with the primary pipe color.

D. Equipment Labels

1. Where specified or directed by the Engineer, the Contractor shall label, in the same manner as the pipe, the individual units of equipment such as blowers, pumps, collector drives, compressors, silencers, etc. All push buttons, starters, switches, etc., when remote from the equipment, shall have labels of the engraved plastic type affixed to or adjacent to the remote switch, push button, starter, etc.

3.22 COLOR SCHEDULE

A. Colors shall be coordinated with the Owner's standard/existing color scheme. If the Owner does not have a standard color scheme, the following schedules shall be used.

B. Piping

Service	Pipe Color	Band Color
Raw Wastewater	Gray	None
Mixed Liquor Suspended Solids	Brown	None
Return Activated Sludge	Brown	Black
Waste Activated Sludge	Brown	Orange
Sludge Re-circulation (Discharge)	Brown	None
Reuse Water	Purple	None
Potable Water	Blue	None
Compressed Air	Green	None

C. OSHA Safety Colors

Service	Color
Fire Protection Equipment, Fire Boxes, Fire Extinguishers, Exit Signs, Fire Sprinkler Piping, Portable Containers of Flammable Liquid, Emergency Stop Bars.	Safety Red
Exposed Box Housings, Exposed Edges of Pulleys, Gears, Etc., Safety Starting Buttons.	Safety Orange
Unguarded Edges of Platforms, Elevated Door Edges, Bollards, Pulley Blocks, Material Handling Equipment.	Safety Yellow
First Aid Kits, First Aid Signs, First Aid Dispensaries, Drinking Water Stations	Safety Green

** END OF SECTION **

SECTION 33 01 10.58
DISINFECTION OF WATER UTILITY PIPING SYSTEMS

1 GENERAL

1.1 DESCRIPTION

A. Provide all labor, equipment, materials, and chemicals required to disinfect portions of the new facilities in accordance with the procedures specified herein.

B. Upon completion of the construction and installation of equipment, the Contractor shall disinfect all potable water lines.

1.2 REFERENCES

A. American Water Works Association (AWWA):

1. C-651 - Disinfection of Water Mains.
2. C-652 - Disinfection of Water-Storage Facilities.
3. C-653 - Disinfection of Water Treatment Plants.

1.3 SUBMI'TTALS

A. Submit the following information in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples:

1. Chemical Data Sheet and manufacturer's information for disinfection agent.
2. Results of bacteriological tests.

2 PRODUCTS

2.1 DISINFECTION AGENT

A. The disinfection agent shall be liquid chlorine, sodium hypochlorite solution or calcium hypochlorite granules or tablets.

3 EXECUTION

3.1 DISINFECTION PROCEDURE

A. Flushing

1. Prior to disinfection, all surfaces shall be thoroughly flushed with clear water.

B. Piping

1. All piping shall be disinfected. Special care shall be exercised to operate all pumps, valves and other appurtenances sufficiently to ensure they are subjected to the chlorinated water during disinfection.

C. Use Chlorination Method 1 as outlined in AWWA C652. (Short description: fill with chlorinated solution sufficient to produce 10 ppm residual after 24 hours.)

D. Upon completion of the disinfection procedure, piping shall be placed into operation and flushed with potable water until the chlorine residual is 1.0 part per million or less. A minimum of two samples of finished water shall be tested for coliform bacteria by an approved testing laboratory.

E. No portion of new work shall be placed in service until disinfection has been completed. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.

F. Chlorinated water shall be dechlorinated prior to being discharged to the environment. One of the neutralizing agents listed in Appendix A of AWWA C653 shall be used for this purpose. Dosage rate of the dechlorinating agent shall be carefully controlled according to the amount of chlorine present in the water.

** END OF SECTION **

SECTION 33 05 05.31
HYDROSTATIC TESTING

1 GENERAL

1.1 SCOPE

A. Furnish all labor, materials, tools, equipment and related items required to perform exfiltration tests of gravity pipelines, perform integrity and leakage tests of pressurized pipelines and perform leakage tests of hydraulic structures.

1.2 SUBMITTALS

A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00, Shop Drawings, Product Data, and Samples.

B. At a minimum, the submittals shall contain, but not be limited to, a description of the testing procedures to be employed for testing and report form to be employed.

2 PRODUCTS

2.1 WATER FOR TESTING

A. Contractor shall procure the necessary water required for testing the work. The Contractor shall be responsible for furnishing all equipment, necessary piping and required labor to transport the water from its source to the test location for use in testing.

3 EXECUTION

3.1 GENERAL

A. The entire length of all pipelines shall be field tested for tightness by a test as described hereinafter.

B. The Contractor shall furnish all labor and equipment, including required pumps with regulated bypass meters and gauges, for conducting pipeline tests.

C. The Contractor shall furnish all equipment, necessary piping and required labor to transport water from its source to the test location for use in testing.

D. Timing and sequence of testing shall be scheduled by the Contractor, subject to the approval of the Engineer. The Contractor shall provide the Engineer with a minimum of 4 hours notice prior to the start of any test. All tests must be observed by the Engineer.

E. The Contractor shall repair any leaks discovered during the initial filling of the pipeline and during the testing sequence. All known and visible leaks shall be repaired whether or not the leakage rate is within allowable limits.

F. The Contractor shall bear complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, air, soap solutions, and any other materials required to conduct the tests.

3.2 NON-POROUS STRUCTURES

A. Non-porous structures, such as steel and fiberglass, shall show no leakage during the 24-hour test period.

3.3 REPAIRS

A. If leakage exceeds the specified allowable limits, the point or points of leakage shall be sought out and remedied by the Contractor at no additional cost to the Owner. Structural leaks shall be made watertight under test within the limits specified.

3.4 TEST PROCEDURES FOR AIR PIPING AND VACUUM PIPING

A. Low Pressure Air Piping

1. Low pressure air piping (working pressures 15 PSI and less) shall be subjected to a pneumatic gauge pressure test. The test pressure shall be 150 percent of the maximum expected operating pressure or 20 PSI, whichever is greater. The pressure shall be maintained for a minimum of 2 consecutive hours. No leakage will be allowed.

B. High Pressure Air Piping and Vacuum Piping

1. High pressure air piping (working pressures greater than 15 PSI) and vacuum piping shall be subjected to a pneumatic gauge pressure test. The test pressure shall be 225 PSI. The pressure shall be maintained for a minimum of 2 consecutive hours. No leakage will be allowed.

3.5 TEST PROCEDURES FOR PRESSURE PIPELINES

A. After all piping has been placed and backfilled between the joints and any concrete reaction blocking has been in place for a minimum of five days, each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.

B. The contractor shall take all precautions necessary to protect any equipment that might be damaged by pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.

C. All piping shall be securely anchored and restrained against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled to adequately secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.

D. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-offs, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.

E. All pipelines shall be segmented by capping, plugging, or closing of valves. Each section of piping shall be pumped full of water and all air shall be removed, to a pressure no less than two times the maximum anticipated operating head or 150 psi, whichever is greater. Pump shall contain adequate gauges to indicate the internal pipe pressure during the test. The above pressure shall be maintained for a minimum of two consecutive hours. Test pressure shall not vary by more than ±5 psi for the duration of the test.

F. After satisfactory completion of the pressure test, a leakage test shall be performed. Leakage shall be defined as the quantity of water that must be supplied to the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled.

G. Allowable leakage in steel pipes shall be zero, except gate valves shall be permitted a maximum leakage rate of one (1) ounce per hour per inch of nominal valve size, in conformance with AWWA C500.

H. Allowable leakage in cast iron and ductile iron pipe shall be in conformance with AWWA C600, Section 4.2 and Table 6.

I. Allowable leakage in concrete and PVC pipe shall be 11.65 gallons per inch of nominal diameter of pipe per mile over a 24-hour period.

J. Any leakage developed during the test shall be corrected at the Contractor’s expense by tightening, replacing packing or gaskets, or replacing defective portions of the piping system. Caulking will not be permitted. If defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility tested without leakage.

K. After all test on any section have been completed to the satisfaction of the Engineer, the Contractor shall carefully clean, blow out, and drain the line of all water to prevent freezing of the same. The Contractor shall also demonstrate to the satisfaction of the Engineer that any and all lines are free from obstruction and foreign material.

3.6 TEST PROCEDURES FOR GRAVITY PIPE

A. Air Pressure Testing

1. Gravity sewer piping shall be low pressure air tested in accordance with UNI-B-6.
2. Low pressure air test shall be witnessed by the Engineer.
3. Gravity sewer lines shall be tested from manhole to manhole. Lines shall be free of dirt and debris and no personnel shall be permitted in the manholes when the test is being conducted.
4. The gravity sewer line shall be pressurized to 4.0 PSIG greater than the average back pressure of any groundwater above the pipe, but no greater than 9.0 PSIG.
5. After temperatures have equalized and the pressure has stabilized at 4.0 PSIG (greater than the average groundwater back pressure), the air supply shall be shut off. The pressure shall then be decreased to no less than 3.5 PSIG (greater than the average groundwater back pressure).
6. The time shall then start and the pressure shall not drop more than 1.0 PSIG during the testing period. The minimum test time for various diameter pipes is presented below.

Nominal Pipe Diameter (inches)	Minimum Test Time (min:sec)	Maximum Length for Minimum Test Time (feet)	Test Time for Longer Length (L) Sections (seconds)
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
16	15:07	149	6.078 L
18	17:00	133	7.692 L
20	18:54	119	9.497 L
24	22:40	99	13.674 L
30	28:20	80	21.366 L
36	34:00	66	30.768 L

7. In general, lateral sewers may be ignored when computing required test time. However, if a section fails to pass the air test when lateral sewers have been ignored, the test time shall be recomputed to include all lateral sewers using the method of calculation in UNI-B-6.
8. Test shall be considered acceptable if pressure does not drop more than 1.0 PSIG during the test period.
9. When unsatisfactory test results are obtained, repair pipe and retest until pipe passes low pressure air test. Repair visible leaks regardless of quantity of leakage.

B. Television Inspection

1. Gravity sewer lines shall be television inspected after the trench is backfilled and compacted.
2. Prior to television inspection, gravity sewer lines shall be cleaned using high pressure water. Water usage for cleaning gravity sewer lines shall be metered.
3. Television inspection shall be performed by an approved contractor using pan and tilt camera.
4. Television inspection shall be witnessed by the Engineer.

5. Television inspection shall be recorded.
6. At a minimum, the television inspection shall look for the following deficiencies.
    a. Cracks in the pipe and/or lining
    b. Rolled gaskets
    c. Leaking joints
    d. Deviations from line and grade
    e. Pipe deformations
    f. Other deficiencies
7. A television inspection report containing the following information shall be submitted to the Engineer.
    a. Length of pipe between manholes
    b. Location of services
    c. Deficiencies
    d. No paving shall be done until gravity sewer lines are passed by the Engineer.

C. Mandrel Testing

1. If the television inspection indicates that there is excessive deflection of the sewer line or that the sewer line is egg shaped, the sewer lines shall be tested for deformation using a mandrel in accordance with ASTM D3034.
2. The sewer line shall be capable of passing a mandrel which has a diameter that is 95 percent of the diameter of the sewer line.
3. Any sewer line that fails the mandrel test shall be re-laid or replaced as required.

** END OF SECTION **

SECTION 40 05 31.13
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

1 GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) pipe and fittings as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

A. Use only pipe and fittings manufactured in the USA.

B. All pipe shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and Commercial Standard tests and certified copies of the test reports covering each shipment shall be submitted to the Engineer prior to laying.

C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:

1. Nominal size
2. Type and grade of material and ASTM standard
3. SDR, class, or schedule rating
4. Manufacturer
5. ANSI/NSF seal of approval

1.3 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00, Shop Drawings, Product Data, and Samples.

1.4 STORAGE AND PROTECTION

A. PVC pipe and fitting shall be stored and protected in accordance with the requirements of the manufacturer, this section, and Section 01 66 00, Product Storage and Handling Requirements.

B. Protect pipe and fittings stored outdoors from direct exposure to sunlight. Covers must be non-transparent and covering must provide adequate air circulation above and around the pipe to prevent excessive heat absorption.

C. Store pipe on level ground in the unit packages provided by the manufacturer.

D. Do not stack pipe more than 8 feet high.

E. When stacking pipe, make sure the weight of the upper pipe units does not cause deformation of the lower pipe units. Stack palletized pipe wood on wood.

F. Do not store pipe in tightly enclosed areas subject to elevated temperatures or close to heat producing sources.

G. Do not drop pipe, drop objects on pipe, or subject pipe to external loads.

H. Do not drag pipe across the ground or over obstacles.

I. Remove pipe or fittings found with any scratches, splits, or gouges from the job site.

1.5 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties and Bonds.

2 PRODUCTS

2.1 MATERIALS

A. Schedule 80 Polyvinyl Chloride (PVC) Pipe
   1. PVC Material: Type 1, Grade 1 with Cell Classification 12454 per ASTM D1784
   2. Construction: Iron pipe size per ASTM D1785
   3. Maximum Service Temperature: 140 °F
   4. Color: Dark Gray

B. Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pipe
   1. PVC Material: Type 4, Grade 1 with Cell Classification 23447 per ASTM D1784
   2. Construction: Iron pipe size per ASTM F441
   3. Maximum Service Temperature: 200 °F
   4. Color: Light Gray

C. Schedule 80 Polyvinyl Chloride (PVC) Fittings
   1. PVC Material: Type 1, Grade 1 with Cell Classification 12454 per ASTM D1784
   2. Construction: Per ASTM D2467
   3. Maximum Service Temperature: 140 °F
   4. Color: Dark Gray

D. Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Fittings
   1. PVC Material: Type 4, Grade 1 with Cell Classification 23447 per ASTM D1784
   2. Construction: Per ASTM F439
   3. Maximum Service Temperature: 200 °F
   4. Color: Light Gray

E. Primer
   1. Conform to ASTM F656

F. Solvent Cement
   1. PVC: Conform to ASTM D2564
   2. CPVC: Conform to ASTM F493

G. Polyvinyl Chloride (PVC) Sewer Pipe
   1. PVC Material: Cell Classification 12454-B in accordance with ASTM D1784
   2. Thickness Class: SDR 26 in accordance with ASTM D3034
   3. Joints: Bell and spigot type in accordance with ASTM D3212
   4. Gaskets: Plain rubber gaskets in accordance with ASTM F477
   5. Color: Green

3 EXECUTION

3.1 INSTALLATION

A. Cutting
   1. Make square and smooth cuts using cutting tools that are designed for use on plastic pipe.
   2. Remove burrs from outside and inside of pipe.
   3. Place a 10° to 15° bevel approximately 1/16” to 3/32” in width on the end of the pipe.

B. Solvent Cementing

1. Clean pipe, fittings, and tools so they are free of dirt, moisture, grease, and other contaminants.
2. Condition pipe, fittings, and accessories to same temperature conditions prior to use.
3. Measure socket depth and mark on pipe as a reference mark to ensure pipe is completely bottomed into fitting during assembly.
4. Apply primer to fitting/accessory socket and to pipe end.
5. Apply solvent cement to fitting/accessory socket and to pipe end while primer is still tacky.
6. While both surfaces are still wet with solvent cement, immediately insert the pipe fully into the fitting socket while rotating the pipe ¼ turn. Hold assembly for approximately 30 seconds to ensure initial bonding.
7. Allow solvent cemented assembly to set for 1 to 5 minutes, depending on pipe size and temperature, without any stress on the joint.

C. Buried Pipe Installation

1. PVC and CPVC pipe for underground pressure applications shall be installed in accordance with AWWA C605 with Type 5 embedment.
2. Minimum Depth of Cover: 3-feet
3. Maximum Depth of Cover: 14-feet.

D. Above Ground Installation

1. Support PVC and CPVC pipe and fittings using appropriate pipe supports.
2. PVC and CPVC pipe shall be supported at maximum intervals recommended by the pipe manufacturer; however, the pipe support spacing shall not exceed the distances shown in the following tables.

PVC Pipe Support Spacing (feet)		
Pipe Size (inches)	**Schedule 40**	**Schedule 80**
¼	2	2
3/8	2	2.5
½	2.5	2.5
¾	2.5	2.5
1	2.5	3
1¼	3	3
1½	3	3.5
2	3	3.5
2½	3.5	4
3	3.5	4
3½	4	4.5
4	4	4.5
6	4.5	5
8	4.5	5.5
10	5	6
12	5.5	6.5
14	6	7
16	6.5	7.5
18	7	9
20	8.5	9.5
24	9.5	10.5

CPVC Pipe Support Spacing (feet)		
Pipe Size (inches)	**Schedule 40**	**Schedule 80**
¼	2.5	2.5
3/8	2.5	2.5
½	2.5	2.5
¾	2.5	2.5
1	2.5	3
1¼	3	3
1½	3	3.5
2	3	3.5
2½	3.5	4
3	3.5	4
3½	4	4.5
4	4	4.5
6	4.5	5
8	5	5.5
10	5.5	6
12	6	6.5
14	6	8
16	7	8.5
18	7.5	9
20	7.5	9.5
24	8	10

3. Paint all exposed pipe as specified in Section 09 90 00, Painting and Coating.
4. Outdoor Applications
    a. Protect all pipe installed above ground and outside from freezing using insulation and heat trace tape.
    b. Above ground plastic pipe that is heat traced and insulated shall be CPVC.

3.2 FIELD TESTING PIPE

A. All pressure tests must be witnessed by Engineer.

B. **DO NOT** pressure test piping assembly with air or compressed gas.

C. Pressure test piping assembly with water.

D. All solvent cemented connections must be fully cured prior to pressure testing.

E. Piping assembly must be adequately anchored/restrained prior to pressure testing.

F. Pressure test piping assembly to 200% of maximum working pressure or to the maximum working pressure of the lowest pressure rated component in the system, whichever is less.

G. Test Procedure

1. Slowly fill system with water, venting air from valves at piping run ends and at elevations during the filling process.
2. Any slow buildup of gauge pressure or any fluctuating gauge needle on a completely liquid filled system is a strong indication that entrapped air is present in the system. In this case, immediately release pressure and re-bleed line.
3. Pressurize system to test pressure using hydraulic hand pump or water supply line, if pressure is sufficient.
4. System must hold pressure for a minimum of 2-hours to demonstrate system integrity.
5. If leak is found or pressure is not maintained, relieve remaining pressure, cut-out failed sections, replace, and allow time to cure properly prior to retesting.

** END OF SECTION **

SECTION 40 05 51
VALVES

1 GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor, materials, and equipment required to install, test, and place into satisfactory operation all valves and valve appurtenances as shown on the Drawings and/or specified herein.

1.2 SUBMITTALS

A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01300, Submittals.

B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:

1. Drawings showing plan, elevation, and appropriate cross sections of the valves being provided. Drawings shall clearly show the location and position of the valve operator for each valve provided.

2. Complete engineering data including, but not limited to, descriptive data, material specifications, and piping diagrams, as appropriate, to support the design of the valves being provided.

3. A complete description of the warranty to be provided.

1.3 OPERATION AND MAINTENANCE DATA

A. The Contractor shall provide operation and maintenance data in accordance with the requirements of Section 01730, Operating and Maintenance Data.

1.4 STORAGE AND PROTECTION

A. Equipment shall be stored and protected in accordance with the requirements of the manufacturer and Section 01620, Storage and Protection.

B. Valves shall be completely drained prior to shipment. Ends of flanged and mechanical joint valves shall be protected with full size wooden baffles securely bolted to the valve ends. Size of baffles shall be at least equal to outside diameter of flange. Valves 24-inches in size and larger shall be secured to a wooden skid to facilitate handling and storage.

1.5 WARRANTIES AND BONDS

A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01740, Warranties and Bonds.

B. The valve manufacturers shall provide a warranty against defective or deficient equipment, workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

1.6 QUALITY ASSURANCE

A. General

1. The valve manufacturers shall furnish a written certification to the Engineer that all valves comply with all applicable requirements of the governing AWWA standards specified herein.

B. Manufacturer

1. Valves and equipment furnished under this section shall be the product of firms regularly engaged in the design and manufacture of such equipment for a minimum of five (5) years.

C. Installer

1. Installation, calibration and testing of valves and equipment furnished under this section shall be performed by qualified, skilled technicians who are regularly engaged in such activities involving systems of similar complexity, and who possess all licenses and certificates required to perform such work.

2 PRODUCTS

2.1 GENERAL

A. Contractor shall note that all valves, especially in the smaller sizes, are not necessarily shown completely on the drawings, which are more or less schematic. However, the Contractor shall furnish and install all valves indicated or required for proper operation of the equipment or services requiring such valves.

B. Contractor shall be responsible for coordinating the location and position of valve operators. Operator positions for each valve shall be clearly shown in the shop drawings.

C. Each valve body shall have cast thereon the word “OPEN,” an arrow indicating the direction to open, and flow direction arrows.

2.2 VALVES

1. Stainless Steel Ball Valves (3” and Smaller)
   a. Threaded, 2-piece, standard port ball valves.
   b. Body: Type 316 stainless steel (CF8M)
   c. Ball: Type 316 stainless steel (ASTM A276)
   d. Stem: Type 316 stainless steel (ASTM A276)
   e. Packing: PTFE
   f. Cold Working Pressure: Minimum 600 PSI
   g. End Connections: FNPT x FNPT
   h. Lever: Type 304 stainless steel with vinyl cover
   i. Manufacturers
      1) Conbraco Industries, Apollo Valves
      2) Nibco, Inc.
      3) Engineer approved equal.
2. PVC Ball Valves
   a. True Union Ball Valves
   b. Body Material: PVC Cell Class 12454 per ASTM D1784
   c. Full port design
   d. Reversible PTFE seats
   e. End Connections: True Union SOC x True Union SOC
   f. Seals: FPM
   g. Ball Valves used for sodium hypochlorite service shall be vented type.
   h. Pressure Rating
      1) ½” to 2” Valves: 250 PSI @ 70°F Non-Shock
      2) 2½” to 4” Valves: 235 PSI @ 70°F Non-Shock
   i. Manufacturers
      1) Hayward Industries, Inc.

2) Engineer approved equal.

B. Solenoid Valves

1. Air Service
   a. Normally closed, 2-way solenoid valve.
   b. Body shall be brass when used in steel piping systems or Type 316 stainless steel when used in stainless steel piping systems.
   c. Minimum 150 PSI working pressure.
   d. Threads shall be FNPT.
   e. Seals and discs shall be PTFE.
   f. 120V, 60 hertz, single-phase power.
   g. Solenoid valves shall be rated for Class I, Division 2 service.
   h. Manufacturers
      1) ASCO
      2) Engineer approved equal.
2. Chemical Service
   a. Normally closed, 2-way solenoid valve.
   b. Body shall be CPVC or other material suitable for the chemical that valve is in contact with.
   c. Minimum 80 PSI working pressure at 140°F.
   d. Threads shall be FNPT.
   e. Seals and discs shall be FKM or PTFE.
   f. 120V, 60 hertz, single-phase power.
   g. Solenoid valves shall be rated for Class I, Division 2 service.
   h. Manufacturers
      1) Plast-O-Matic Valves, Inc.
      2) Engineer approved equal.

C. Strainers

1. Strainers for carbon steel piping systems:
   a. Threaded, bronze Y-strainer.
   b. Body: Lead-Free Bronze
   c. Screen: Type 304 stainless steel
   d. Cold Working Pressure: Minimum 200 PSI
   e. End Connections: FNPT x FNPT
   f. Manufacturers
      1) Conbraco Industries, Apollo Valves
      2) Nibco, Inc.
      3) Engineer approved equal.
2. Strainers for stainless steel piping systems:
   a. Threaded, stainless steel Y-strainer.
   b. Body: CF-8M stainless steel
   c. Screen: Type 304 stainless steel

d. Cold Working Pressure: Minimum 200 PSI

e. End Connections: FNPT x FNPT

f. Manufacturers

1) Conbraco Industries, Apollo Valves

2) Nibco, Inc.

3) Engineer approved equal.

2.3 MANUAL VALVE OPERATORS

A. Unless otherwise shown or specified, butterfly and plug valves shall be furnished with manual operators as follows:

1. Butterfly valves and plug valves 8” and smaller that are installed above grade and less than 7 feet above the working surface shall have a lever operator.

2. Butterfly valves and plug valves greater than 8” that are installed above grade and less than 7 feet above the working surface shall have a rotary operator with handwheel.

3. Butterfly valves and plug valves located more than 7 feet above the working surface shall have a rotary operator with chainwheel.

4. Butterfly valves and plug valves 8” and smaller that are installed for buried service shall have a 2” operating nut, extension stem, and valve box.

5. Butterfly valves and plug valves greater than 8” that are installed for buried service shall have a rotary operator with extension stem, 2” operating nut, and valve box.

B. Unless otherwise shown or specified, gate valves shall be furnished with manual operators as follows:

1. Gate valves that are installed above grade and less than 7 feet above the working surface shall have a handwheel operator.

2. Gate valves that are installed above grade and more than 7 feet above the working surface shall have a chainwheel operator.

3. Gate valves that are installed for buried service shall have a 2” operating nut, extension stem, and valve box.

4. Gate valves that are installed in a deep vault or are submerged shall have an extension stem with floor stand and a handwheel operator.

C. Operating nuts for buried valves shall be standard 2” square nuts and shall conform to AWWA C500. Extension stems, valve boxes, and stem guides shall be furnished where shown, specified, or required for proper operation.

D. Hand lever operators shall have heavy-duty cast iron bracket, cast iron latching lever, and self-lubricating bushings and shall be capable of securing the valve in any position. Lever operators shall be installed so that the lever is parallel with the axis of the pipe in which the valve is installed when the valve is fully open.

E. Rotary manual operators for aboveground service shall be of the worm gear or traveling nut type. Rotary operators shall have a heavy-duty, weatherproof cast iron or steel housing with gasketed, removable cover and shall be equipped with a mechanical dial or slot type position indicator and suitable hand wheel. Manual operators shall be totally enclosed and sealed to prevent the entrance of rain, dirt, and corrosive atmospheres. Traveling nut operators shall have a grease lubricated alloy steel screw stem, brass nut, and self-lubricating bronze bushings. Worm gear operators shall have hardened, grease-lubricated alloy steel worms and bronze worm gears. All exterior bolts and fasteners shall be bronze or stainless steel for corrosion resistance. The valve shall open with counterclockwise rotation of the hand wheel.

F. Rotary manual operators for buried service shall conform with the paragraph above except, the operator shall be totally enclosed and completely sealed to prevent the entrance of water and dirt. Buried operators shall be coated with a bituminous coating. Manual rotary

operators shall be capable of withstanding 300 foot-pounds of torque on the operating nut or hand wheel. A corrosion resistant, dial type valve position indicator shall be provided at the operating nut on the extension stem of the buried operators to provide a remote indication of valve position.

G. Chain wheel operators shall be of heavy cast iron construction and shall be equipped with chain guide and looped, flexible, operating chain. Chain shall be galvanized or cadmium plated and shall extend to within 48-inches of the floor.

H. All manual rotary and lever operators shall be capable of seating or unseating the valve disc under the most adverse conditions in the particular application with no more than an 80-pound pull on the hand wheel or lever. Valve operators shall be capable of holding the valve in any position between fully open and fully closed without creeping or fluttering. Operators shall be provided with adjustable, mechanical, stop-limiting devices to prevent over-travel of the valve disc in the open and closed positions. Manual rotary and lever operators shall comply with all applicable requirements of AWWA C504.

I. Contractor shall be responsible for coordinating the location of valve operators. Operator locations for each valve shall be clearly shown for each valve on the shop drawings.

2.4 EXTENSION STEMS

A. Extension stems shall be solid steel not smaller than the stem of the valve. Extension stems shall connect to the valve by a flexible socket coupling. All couplings shall be pinned, keyed, or socket type.

B. Extension stems for buried service valves shall extend to within 6” of the top of the valve box or floor box and shall be provided with spacers which will center the stem in the valve box. A standard 2” nut shall be provided on the top of the extension stem.

C. Stem guides shall be bronze-bushed, cast iron construction adjustable in two directions. Stem guides shall be installed so the unsupported length of the extension stem does not exceed 10 feet or an L/r of 200.

2.5 VALVE BOXES

A. All buried valves shall be provided with 3-piece, cast iron, extension sleeve type valve boxes suitable for the depth of cover as shown on the Drawings.

B. Valve boxes shall not be less than 5” in diameter, shall have a minimum thickness of 3/16” at any point, and shall have cast thereon an appropriate name designating the service for which the valve is intended (“W” for water, “S” for sanitary). Cover in roadways shall be of the deep locking type.

C. All parts of valve boxes, bases, and covers shall be heavily coated with a suitable bituminous finish.

D. Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves with the top of the box flush with the finished grade.

2.6 T-HANDLE OPERATING WRENCH

A. The Contractor shall furnish two (2) T-handle, steel valve operating wrenches with sockets compatible with standard 2” square valve operating nuts.

B. Length of operating wrenches shall be long enough to extend from the operating nut to 36” above the finished grade.

2.7 PAINTING

A. All internal cast or ductile iron surfaces, except finished or bearing surfaces, shall be shop painted with two coats of asphalt varnish conforming to Federal Specification TT-C-494.

B. All exterior steel or cast or ductile iron surfaces of each valve, except finished or bearing surfaces, shall be shop painted with one or more coats of Alkyd primer. Valves for buried service shall have two coats of Alkyd primer. Valves for buried service shall have two coats of asphalt varnish per Federal Specification TT-C-494.

C. All exposed valves shall be field primed and painted in accordance with the requirements of the section entitled “Painting” of these specifications.

2.8 SHOP TESTING

A. All ball valves shall be subjected to hydrostatic, shop leakage and performance tests as specified in AWWA Standard C507.

B. All butterfly valves shall be subjected to hydrostatic, shop leakage and performance tests as specified in AWWA C504.

C. All check valves shall be subjected to hydrostatic, shop leakage and performance tests as specified in AWWA C508.

D. All gate valves shall be subjected to hydrostatic, shop leakage and performance tests as specified in AWWA Standard C500.

E. All plug valves shall be subjected to hydrostatic, shop leakage and performance tests as specified in AWWA Standard C517.

F. All other valves shall be subjected to hydrostatic test at two times the rated pressure of the valve, shop leakage and performance tests. During the hydrostatic test, there shall be no leakage through the metal, the end joints, or the shaft stem seal, nor shall any part be permanently deformed. Leakage shall not exceed that permitted by ANSI B16.104, Class IV, for metal-seated valves and Class VI for resiliently seated valves.

3 EXECUTION

3.1 INSTALLATION

A. All valves and appurtenances shall be installed in strict conformance with the drawings and manufacturer’s instructions.

B. Valves shall be installed in such a way that operators and packing are easily accessible. Valves with field replaceable seats shall be installed with sufficient clearance to permit removal of valve bonnet and stem without removing valve from the line.

3.2 FIELD TESTING

A. Following installation, all valves shall be tested by the Contractor under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the Engineer. The Contractor shall at his own expense adjust and/or replace any valve as necessary to assure satisfactory operation.

B. Following installation and testing, all ferrous and non-machined surfaces of exposed valves, operators, floorstands, and stem guides shall be field primed and painted with a finish suitable for the intended service in accordance with the requirements of Section 09 90 00, Painting.

** END OF SECTION **

SECTION 40 41 13
PROCESS PIPING HEAT TRACING

1 GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test heat tracing tape and accessories as shown on the Drawings and/or specified herein.

B. All exterior exposed, liquid carrying, piping 12-inches and less in diameter shall be heat traced for freeze protection. Piping larger than 12-inches in diameter shall be heat traced for freeze protection where shown or specified on the Drawings.

C. All heat traced piping shall be insulated in accordance with Section 40 42 13, Process Piping Insulation.

D. Heat trace design shall be provided by heat trace supplier.

1.2 QUALITY ASSURANCE

A. Store materials in accordance with manufacturers written instructions and Section 01 66 00, Product Storage and Protection.

B. Factory Mutual approved constant wattage cable.

C. UL Listed thermostat and contactor panel

D. UL Listed control/monitor panel

1.3 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

B. Provide heat trace calculations and bill of materials.

1.4 STORAGE AND PROTECTION

A. Materials shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.5 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

2 PRODUCTS

2.1 HEAT TRACING

A. Heat tracing system consisting of heat trace cable and all accessories, thermostats, sensors, tape for securing cable, end termination kits, power connection kits, splicing kits, caution labels, etc. required for a complete and operable system shall be provided by the heat tracing system manufacturer.

B. Heat tracing shall be of the parallel circuit, self-limiting, semiconductor type electric resistance heat tracing suitable for cut-to-length field installation. Heat tracing shall be waterproof and chemical resistant. In locations identified as Class I, Division 1 or 2 hazardous locations, heat tracing shall be UL listed and FM approved for Class I, Division 1 or 2 hazardous locations, respectively.

C. Heat tracing shall have a watt per foot rating at 50°F as follows:

Pipe Size (inches)	Insulation Thickness (inches)	Watts Per Foot
1 and smaller	1	2.0
1½	1½	2.0
2	1½	2.2
2½	1½	2.5
3	1½	2.9
4	1½	3.5
6	2	3.9
8	2	4.8
10	2	5.8
12	2	6.7

D. Heat tracing strip shall have a flat profile and shall be furnished with a noncorrosive metal braid shield or jacket. Unless otherwise shown or required, heat tracing shall operate at 120 volts, 60 hertz, single phase.

E. Heat tracing rated 5 watts per foot or less shall be suitable for ambient temperature control and shall not be damaged if crossed in direct contact.

F. Heat tracing rated 5 watts per foot or less shall be controlled by a separate, liquid-filled, ambient sensing thermostat. Thermostat shall have a tamperproof calibrated setpoint dial SPST or SPDT contacts rated minimum 20 amps at 120 volts, a cast aluminum NEMA 4 enclosure.

G. Heat tracing rated in excess of 5 watts per foot shall be controlled by a separate, pipeline sensing, liquid-filled thermostat with stainless steel bulb and a minimum 10 feet of flexible stainless steel capillary tubing. Thermostat shall have a tamperproof, calibrated setpoint dial, SPST or SPDT contacts rated minimum 20 amps at 120 volts, 6°F differential, and a cast aluminum NEMA 4 enclosure.

H. Thermostats shall be furnished by the heat tracing manufacturer and shall be adjustable over an operating range of 25°F to 90°F.

I. Circuit breakers used to protect electric heat tracing circuits shall be of the ground fault interrupter type, 30mA, rated for heat trace application.

2.2 ALUMINUM FOIL TAPE

A. Aluminum foil tape shall be placed on non-metallic pipe to improve heat transfer.

B. Aluminum foil tape shall be 2-mil high strength dead soft aluminum foil coated with cold-weather solvent acrylic pressure sensitive adhesive that is compatible with the heat tracing.

C. Aluminum foil tape shall be Venture Tape 1520CW, or equal.

3 EXECUTION

3.1 GENERAL

A. All necessary fittings, tape, end seals, and other accessories shall be furnished.

3.2 INSTALLATION

A. Install heat tracing in accordance with IEEE 515.1.

B. Non-metallic pipes shall be spiral wrapped with aluminum foil tape.

1. Pipe shall be cleaned prior to wrapping.
2. Tape shall have a minimum 0.25-inch overlap.

C. Install heat tracing cable after piping has been tested and before insulation is installed.

D. Heat tracing cable shall be installed in a continuous straight strip along the pipe or spirally wrapped as required to obtain the necessary watt density. An additional turn shall be taken around valves, fittings and strainers.

E. Length of circuits shall not exceed the rating of the controlling thermostat or the maximum circuit length specified by the manufacturer.

F. Heat tracing shall be secured to the pipe using heat-resistant tape at intervals of 12 inches or less. Heat tracing shall be protected from damage and from the weather until weather resistant insulation jackets are in place.

G. After installation and before applying insulation, test the system for grounds and short circuits using a 500 VDC meter. Insulation resistance should exceed 10,000 megaohms per 250 feet.

** END OF SECTION **

SECTION 40 42 13
PROCESS PIPING INSULATION

1 GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor, equipment, and materials required to install pipe insulation and accessories as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

A. Store materials in accordance with manufacturers written instructions and Section 01 66 00, Product Storage and Protection.

B. All insulation and accessories is to be installed by a licensed applicator and applied in accordance with manufacturer's recommendations.

1.3 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

1.4 STORAGE AND PROTECTION

A. Materials shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.5 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

2 PRODUCTS

2.1 PIPE INSULATION

A. Preformed rigid, noncombustible, fiberglass pipe insulation complying with ASTM C547, Type 1.

B. Thermal Conductivity, k: 0.24 BTU*in/(hr*ft^2*°F) at 75°F mean temperature

C. Maximum Service Temperature: 850°F

D. Flame Spread Index: < 25 per ASTM E84, UL 723, and NFPA 255

E. Smoke Developed Index: < 25 per ASTM E84, UL 723, and NFPA 255

F. Thickness

1. Piping 1" Diameter and Smaller: 1"
2. Piping 1½" to 4" Diameter: 1½"
3. Piping Greater Than 4" Diameter: 2"

G. When being used over stainless steel, pipe insulation must comply with the requirements of ASTM C795.

H. Provide with all-service vapor-retarder jacket. Vapor-retarder jacket shall be a white, kraft paper, reinforced with a fiber yarn and bonded to an aluminum foil with self-sealing longitudinal closure laps and butt strips.

2.2 ALUMINIUM JACKETS

A. Aluminum Jacket: 0.016" thick sheet, embossed finish, with longitudinal slip joints and 2" laps, die-shaped fitting covers with factory-attached protective liner.

3 EXECUTION

3.1 INSTALLATION

A. Ensure that the surfaces over which the insulation is going to be installed are clean and dry.

B. Ensure the insulation is clean, dry, and in good mechanical condition with factory-applied vapor or weather barriers intact and undamaged. Do not install wet, dirty, or damaged insulation.

C. Ensure that pressure testing of piping and fittings has been completed prior to installation.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over piping surfaces.

E. Maintain the integrity of factory-applied vapor retarder jacketing on pipe insulation, protecting it against puncture, tears or other damage. Seal circumferential joints with butt strips that are compatible with vapor retarder jacket facing.

F. On cold systems, seal penetrations of the vapor retarder jacket and exposed ends of insulation with vapor barrier mastic. Mastic pipe section ends at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

G. Cover valves, fittings, and similar items in each piping system with one of the following:

1. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
2. Insulation cement, equal in thickness to the adjoining insulation.
3. PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

H. Seal fitting joints with vapor retarder sealing tapes or mastics.

I. Use standard oversizing practices for valves and flanges.

J. Butt pipe insulation against hanger inserts and pipe supports.

K. After insulation is installed, install aluminum jacket over insulation. Overlap metal jacket 2 to 3 inches and hold in place with metal bands. Seal all joints with solvent welding adhesive.

3.2 FIELD QUALITY ASSURANCE

A. Upon completion of insulation work, visually inspect the work and verify that it has been correctly installed.

3.3 PROTECTION

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

B. Protect completed work during the remainder of the construction period to avoid damage and deterioration of the finished insulation work.

** END OF SECTION **

SECTION 46 00 03
GENERAL EQUIPMENT STIPULATIONS

1 GENERAL

1.1 SCOPE

A. These General Equipment Stipulations apply, in general, to all equipment and piping as explained herein.

1.2 COORDINATION

A. The Contractor shall assume full responsibility for the coordination of the installation of all equipment, materials and products furnished under these Contract Documents. The Contractor shall be completely responsible for verification that all structures, piping and equipment components furnished by him and/or his Subcontractors and Suppliers are compatible. The Contractor shall start up each equipment system and shall make all necessary adjustments to place each system in proper operating condition.

1.3 ADAPTATION AND LOCATION OF EQUIPMENT

A. Equipment shall be readily adaptable for installation and operation in the structures to be constructed under other Contracts. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment which requires alteration of the structures will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense.

B. The Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc., be as neatly installed and out-of-the-way as physically possible. All equipment, piping, ductwork, conduit, etc., shall be installed to provide needed maintenance and passage space.

1.4 PATENT ROYALTIES

A. All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment shall be included in prices bid by the Contractor.

1.5 EQUIPMENT GUARANTEE

A. The Contractor and equipment manufacturer shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective materials, breakage or other failure. Manufacturers of equipment included in these specifications shall warrant the units being supplied to the Owner against defects in workmanship and material under normal use, operation, and service for a period of 1 year from the date of final acceptance of the work by the Owner unless an extended warranty is otherwise specified under individual equipment sections.

B. The Contractor shall furnish and replace, without cost to the Owner, all equipment parts that are defective or show undue wear within the warranty period.

C. The Warranty shall be in a printed form and apply to all components of the unit supplied by the Manufacturer.

1.6 WORKMANSHIP AND MATERIALS

A. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests. All bolts, nuts, fastenings, pipe and fittings shall be manufactured in conformance with the United States system of measurement.

B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to

ASTM A 48, Class 30 minimum. Plugging of defective castings shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads.

D. All replaceable or expendable elements such as filters, screens, drive belts, fuses, indicator lamps, etc., shall be easily accessible and replaceable without need of dismantling equipment or piping. All such items shall be of a standard type that is readily available from multiple suppliers.

E. Threaded openings for drains or vents in pump volutes, compressor or fan scrolls, air receivers, and heat exchangers which are plugged during normal operation shall be provided with stainless steel plugs.

1.7 LUBRICATION AND LUBRICATION FITTINGS

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 start up or shut down and shall not waste lubricants.

B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity by the Contractor to fill all lubricant reservoirs and to replace all lubricants consumed during testing, start up, and initial operation. The Contractor shall provide sufficient quantities of lubricants to lubricate all equipment for one year of normal service before final acceptance of the equipment will be made by the Owner.

C. Where special run-in oil or storage lubricants are used, they shall be flushed out and replaced with the required service lubricant by the Contractor.

D. Tag each piece of equipment with cloth tag showing proper type lubricant, period between lubrications, date of lubrication, and worker's initials. Have space for ten lubrication notations.

E. Except for rotating shaft couplings, all lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards. Fittings shall be accessible from safe, permanent platforms or walk areas. Fittings shall be of the bull-neck, check type for use with a portable high pressure grease gun. Connection from a remote fitting to the point of use shall be with minimum 3/16-inch stainless steel tubing, securely mounted parallel to equipment lines and protected where exposed to damage.

1.8 ELECTRIC MOTORS

A. Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following:

1. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.

2. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.

3. All motors shall be rated for continuous duty at 40°C ambient. Motor temperature rise above 40°C ambient on continuous operation at nameplate horsepower shall not exceed the NEMA limit for 1.0 service factor and Class B insulation.

4. Motors shall be designed for full voltage starting. Motors shall operate under a ±10 percent voltage variation and ±5 percent frequency variation.

5. Motor-bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.

6. Motors shall be sized for the altitude at the location where the equipment is to be installed.

7. Motors shall be sized so that, under maximum continuous load imposed by the driven equipment, the motor nameplate horsepower for continuous operation in 40°C ambient is at least 15 percent more than the driven load. Continuous equipment load shall not exceed 87 percent of motor nameplate horsepower, whether motor service factor is 1.0 or higher.
8. Where the detailed specifications call for encapsulated motor windings, the motor shall have a sealed insulation system designed for a more severe environment than usual varnish treatments can withstand. The insulation system shall be General Electric "Polyseal", Allis-Chalmers "Poxeal", U. S. Motors "Everseal", or equal. Motors in this case may be single voltage rated.
9. Motors shall have a clamp-type grounding terminal inside the motor conduit box.
10. Motors with external conduit boxes shall have oversized conduit boxes.
11. Motors in occupied areas shall be quiet rated and so marked.

B. It is the intent of this general specification to allow the manufacturer's standard motor on integrally-constructed, motor-driven equipment such as appliances, hand tools, etc., that is specified by model number in which a redesign of the complete unit would be required for a motor with other features as may be specified herein.

C. Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:
1. Below 3/4 horsepower:
a. 115-volt, 60-hertz, single phase
b. Totally enclosed, fan-cooled
c. Permanently lubricated, sealed bearings
d. Built-in manual-reset thermal protector; or furnished with integrally mounted stainless steel enclosed manual motor-overload switch
2. 3/4 to 1 horsepower:
a. 230/460-volt, 60-hertz, 3-phase
b. Totally enclosed, fan cooled
c. Specially insulated for use in damp locations below 20°C
d. Grease-lubricated, antifriction bearings.
3. 1½ horsepower and above:
a. 230/460-volt, 60-hertz, 3-phase
b. Totally enclosed, fan-cooled
c. Specially insulated for use in damp locations below 20°C
d. Grease-lubricated antifriction bearings or oil-lubricated sleeve bearings
e. Vertical motors shall have 15-year average-life thrust bearings.

D. Any motor, installed in a wet-well, in an area which is physically connected to a wet-well, or in an area that is classified Class 1, Division 1 shall be explosion proof.

E. Any motor installed in a classified area shall be designed to operate in the specific classified environment.

1.9 DRIVE UNITS

A. Except when specified otherwise in the detailed equipment specifications, 87 percent of the nameplate horsepower rating of each drive motor shall be at least equal to the theoretical brake horsepower required to drive the equipment under full load, including all losses in speed reducers and power transmission.

B. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor.

C. Drive units shall be designed for 24-hour continuous service and shall be constructed so that oil leakage around shafts is precluded.

D. Gear Motors

1. Gear motors shall be rated AGMA Class II and shall bear an AGMA nameplate.

E. Gear Reducers

1. Each gear reducer shall be totally enclosed, oil lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.25. Shaft-mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.40. Each gear reducer shall bear an AGMA nameplate or the manufacturer shall certify that the gear reducer is designed and rated in accordance with AGMA standards.

F. Chain Drives

1. Chain drives shall utilize roller chain having an ultimate strength of not less than 10 times the maximum working load.

G. V-Belt Drives

1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. Fixed ratio V-belt drives shall have a service factor of at least 1.5 based on motor nameplate horsepower.

H. Couplings

1. Couplings between motors and drives or between drives and the driven equipment shall have a service factor of not less than 1.25 based on motor nameplate horsepower. Couplings between drives and the driven equipment shall have a service factor not less than that of the drive based on motor nameplate horsepower. All couplings rotating at speeds less than 900 rpm shall be of all steel construction. In general, couplings shall be of the tapered grid steel spring type or the crowned gear type.

I. Overtorque Protection

1. All low speed, high torque drives for equipment such as mechanical screens, conveyors, and clarifier and thickener mechanisms shall be protected against excessive torque by means of a suitable overtorque protection device. Acceptable devices shall include torque switches, shear pins, shear keys, and full-release torque couplings. Torque limiting couplings using sliding surfaces or friction to limit torque shall not be used.

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 gauge or heavier galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. 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. All safety guards shall comply with OSHA General Industry Standards, Part 1910, Subpart O, Machinery and Machine Guarding. Provide tachometer access on shaft ends.

1.11 ANCHOR BOLTS

A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts and two washers shall be furnished for each bolt. Anchor bolts to be embedded in concrete shall be provided with sufficient threads to permit a nut and washer to be installed on the concrete

side of the concrete form or supporting template, but in no case shall bolts be threaded less than 2 inches. Anchor bolts used in anchoring rotating or vibrating equipment shall be provided with suitable lock washers.

B. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit a minimum of one inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Individual, embedded anchor bolts for heavy equipment shall be centered in a steel pipe sleeve having an inside diameter approximately two times the bolt diameter and an embedded length approximately 8 times the bolt diameter.

C. Bolts specified to be bent shall be bent cold. Bend radius shall not be less than twice the bolt diameter. Unless otherwise shown or specified, anchor bolts shall be embedded in concrete a minimum distance of 15 times the bolt diameter. Unless otherwise shown or specified, all anchor bolts shall be at least ½- inch in diameter.

D. All embedded anchor bolts or anchor bolt materials shall be ASTM A 276, Type 316 stainless steel threaded per ANSI B1.1. Nuts shall be heavy hex nuts, ANSI B18.2, semifinished pattern, and shall be ASTM A194 Grade 316 stainless steel. Flat washers shall be Type 316 stainless steel.

E. Adhesive anchors shall be used to anchor equipment to existing concrete. Anchors shall be stainless steel, Type 316. Installation methods shall be in conformance with the manufacturer's recommendations for maximum pullout and shear strength, but in no case shall the depth of the hole be less than 8 bolt diameters or 3 inches, whichever is greater. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall not be less than 5 times the diameter of the hole in which it is installed. The minimum distance between adjacent anchors shall not be less than 10 times the diameter of the hole in which it is installed.

1.12 EQUIPMENT BASES

A. All equipment shall be installed on a raised reinforced concrete base. The base shall be a minimum of 4 inches in height and shall extend a minimum of 2 inches beyond the equipment baseplate on all sides.

B. The electrical contractor shall be instructed concerning electrical conduit locations prior to pouring the concrete base.

C. Unless otherwise specified, a cast iron or welded steel baseplate shall be provided for each pump, compressor, and any other item of equipment which is to be installed on a concrete base. 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 raised lip all around and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with epoxy or non-shrink grout as specified in the grouting section.

D. On direct coupled equipment, motor and driven equipment shall be doweled to a common base with a minimum of two dowels each.

1.13 ALIGNMENT OF MOTORS AND EQUIPMENT

A. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected. Machinery shall first be properly aligned and leveled by means of steel wedges and shims or jacking screws near anchor bolts. Anchor bolts shall be tightened against the shims, wedges, or jacking screws and the equipment shall again be checked for level and alignment before placing grout. Wedges shall not be placed between machined surfaces.

B. In general, checking and correcting the alignment shall follow the procedures set up in the Standards of the Hydraulic Institute, Instructions for Installation, Operation, and Maintenance of Centrifugal Pumps. Equipment shall be properly leveled and brought into angular and parallel alignment.

C. Equipment shall be installed in such a way that no strain is transmitted to the equipment by piping systems or adjacent equipment.

1.14 GROUTING

A. A special epoxy, non-shrink grout shall be used in the placement of all pump, motor, and equipment baseplates or bedplates, column baseplates, other miscellaneous baseplates, and other grouting applications as shown on the Drawings. Grouting materials and installation shall be as specified in Section 03 60 00, Grouting.

1.15 WELDING AND BRAZING

A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding, and Section 328, Brazing and Soldering. All welding qualification tests shall be witnessed by the Engineer, except as provided herein. All costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.

C. Actual welding procedures to be used in field assembly and installation of equipment furnished under this Contract shall be submitted to the Engineer for approval prior to beginning the work. Reports certifying that the welding procedures, welders, and welding operators that the Contractor intends to use are qualified as specified above shall also be submitted to the Engineer prior to beginning the work. In the case of welder qualifications for shop welding and for carbon steel field welding, welders presenting certified qualification papers validated within the preceding 6-month period and acceptable to the Engineer will not be required to take the qualification tests. In the case of field welding of stainless steel or aluminum, all welders shall be required to take the qualification tests regardless of past experience or availability of certified qualification papers.

D. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.

E. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by "Welded Austenitic Chromium-Nickel Stainless Steels, Techniques and Properties", published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.

F. Each welder and welding operator must identify his welds with his assigned symbol.

G. Welders performing unsatisfactory work shall be removed from the welding process.

H. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration, and cracking shall constitute grounds for rejection of welds.

1.16 ERECTION AND SETTING

A. In the erection and setting of all fabricated equipment, the Contractor shall exercise care to ensure that each item of equipment is adequately supported so as not to bend or distort under its own weight until adequate foundation support and anchorage are provided. Where lifting lugs, angles or clips are provided on equipment, they shall be used in erecting and setting the equipment. Erection and setting of equipment and structural steel shall conform to the requirements of OSHA Construction Standards, Part 1926, Subpart R, Steel Erection, Subpart H, Material Handling, Storage, Use, and Disposal, and Subpart N, Cranes, Derricks, Hoists, and Conveyors. Erection of structural steel shall conform to the latest requirements of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

B. During placement and prior to any grouting or connection of adjacent piping the equipment shall be leveled and aligned true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment accurately and securely. It shall not be permitted to cock out of alignment, redrill, reshape, or force fit any fabricated items.

C. The Contractor shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and responsible for these measurements and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all work in the field and the accurate placement of all anchor bolts installed by him.

D. The Contractor shall bring all parts to be erected or assembled into close contact. Before assembly, all surfaces to be in contact with each other shall be thoroughly cleaned. Drift pins may be used only for bringing members into position, never to enlarge or distort holes. Torching or burning of holes or cutting of fabricated items to correct misalignment or shop errors shall not be permitted. Enlargement of holes necessary to make field connections shall be done only with the Engineer's approval by reaming with twist drills and in a manner acceptable to the Engineer.

E. All equipment shall be furnished with suitable eyebolt lifting lugs or lifting angles to facilitate handling.

1.17 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. Special tools and accessories shall include those tools and accessories not normally available in an industrial hardware or mill supply house. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.18 SHOP PRIMING AND PAINTING

A. All equipment shop priming and painting, including surface preparation, workmanship and materials, shall be as specified in Section 09 00 00, Painting.

1.19 FIELD PRIMING

A. All iron and carbon steel surfaces not specified to be galvanized or shop primed and all ferrous or nonferrous surfaces specified to be field primed and painted shall be coated in the field with one or more coats of primer in accordance with the requirements of Section 09 00 00, Painting.

1.20 FIELD PAINTING

A. Except for interior surfaces of vessels and enclosed equipment not specified to be field painted, all ferrous and nonferrous surfaces of equipment which have received one or more coats of shop or field applied primer shall be field painted after installation in accordance with the requirements of Section 09 00 00, Painting.

1.21 GALVANIZING

A. All galvanizing shall be done by the hot-dip process after fabrication in conformity with requirements of ASTM A123, A153, A384, and A385. Articles to be galvanized shall be pickled before galvanizing.

B. Where galvanized bolts are specified or required by the Drawings, cadmium or zinc plated bolts will be acceptable provided cadmium plating conforms to ASTM A165, Type NS, and zinc plating conforms to ASTM A164, Type GS.

C. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleared and recoated with zinc to the required thickness by the hot dip process.

D. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections, and other defects not consistent with acceptable galvanizing practice.

E. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A 239.

1.22 PROTECTION AND STORAGE

A. 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 thoroughly dry at all times. Compressors, blowers, pumps, motors, valves, control panels, instrumentation, electrical equipment, and other equipment having antifriction or sleeve bearings shall be stored in weathertight warehouses which are maintained at a temperature of at least 60°F. Other equipment may be stored outside under cover. All equipment shall be stored above ground level and adequately supported on wood blocking or other approved support material. Printed storage instructions of the manufacturers shall be strictly adhered to.

B. Painted, anodized, or otherwise coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. All coated surfaces which are damaged prior to acceptance of equipment shall be cleaned and coated to the satisfaction of the Engineer with the same or equivalent coating used in the original application.

C. Electrical equipment, motors, controls, and insulation shall be protected against moisture or water damage. All space heaters provided in the equipment shall be kept connected and operating at all times until equipment is placed in service. Electrical equipment stored without space heaters shall be provided with desiccants to protect against moisture damage. Desiccant shall be silica gel in porous bags at not less than one ounce per cubic foot of volume. Desiccant shall be replaced periodically.

D. Electrical equipment and instrumentation shall be stored in a location that is free from excessive or injurious amounts of vibration.

E. Rotating equipment such as pumps, motors, fans, and compressors shall be rotated periodically. In the absence of specific exercising instructions by the equipment manufacturer, each item of rotating equipment shall be rotated a minimum of 10 revolutions at intervals not to exceed 20 days. When shafts are too difficult to rotate by hand, nonmetallic grips shall be used to turn the shafts.

F. Vehicles such as trucks, forklifts, tractors, lawn mowers, and other engine-powered equipment shall be started up and operated at intervals not to exceed 15 days. Equipment shall be run until engine temperatures and pressures are in normal operating ranges. All lifting, lowering, tilting, loading, and unloading accessories shall be operated at least once during the exercise period. Equipment shall be moved under power from the parked position and run a sufficient distance so as to ensure proper lubrication of drive train and suspension components. All operators employed to exercise the vehicles shall be qualified and thoroughly familiar with the proper operation of the equipment. Forklifts, tractors, lawn mowers, and other small engine-powered equipment shall be stored indoors in garages or other suitable structures. Trucks stored outdoors shall be washed using approved materials at intervals not to exceed 15 days. All exercising and storage of vehicular equipment shall be conducted in a manner acceptable to the Engineer.

G. Interiors of gear and bearing cases housing oil-lubricated gears and bearings shall be filled with a rust inhibiting oil prior to storage or, if extended storage is anticipated, coated periodically with a rust inhibiting oil mist at intervals of time acceptable to the Engineer.

Interiors of large pumps and compressors shall be protected using vapor phase inhibitor paper or porous bags of rust inhibiting, vapor emitting crystals. Exposed shafts shall be coated with rust preventative compound then wrapped with oil-impregnated paper and polyethylene film and sealed with waterproof tape prior to shipment.

H. Individually packaged, unpainted steel parts shall be protected by a wrapping of vapor phase inhibiting or oil-impregnated paper and polyethylene film prior to shipment.

I. Parts and equipment not requiring periodic inspection or maintenance shall be stored unopened in their original packaging until used.

J. Parts, instruments, controls, and small items of equipment shall be stored above ground or floor level on suitable shelves or racks in a heated, watertight warehouse.

K. Flanged openings on equipment shall be covered with suitable solid wooden or metal blanks securely bolted to the flange using a minimum of four bolts and a suitable rubber gasket. Ends of threaded pipe and fittings shall be sealed watertight with metal or plastic caps. Threaded openings shall be sealed watertight with metal or plastic plugs. Other openings shall be sealed with two layers of 6-mil polyethylene securely taped in place with waterproof tape.

L. A maintenance log on each item of mechanical and electrical equipment requiring periodic attention in storage shall be maintained by the Contractor. Oil and grease changes, exercising, desiccant replacement, nitrogen purge checks, heater checks, insulation checks, and other periodic maintenance shall be entered in the log. The maintenance log shall be made available to the Engineer on request.

M. A resistance test shall be performed on all motor windings and heater elements following storage and prior to installation as a check for insulation deterioration or moisture damage during storage.

N. Immediately prior to installation, equipment shall be cleaned of any protective coatings used during storage and any rust, dirt, grit, or other foreign material shall be removed.

O. After installation and prior to start-up, all grease-lubricated joints, shaft couplings, and bearings shall be flushed out and re-greased. All oil reservoirs and sumps shall be completely drained and flushed and refilled with the proper lubricant. Screens and filters shall be checked for contamination and replaced if necessary. The equipment shall then be tagged, signed, and dated, indicating that the equipment has been properly lubricated for start-up.

P. After storage, rubber parts such as valve seats, diaphragms, expansion joints, gaskets, hoses, and shaft couplings shall be checked for hardening or cracking. Deteriorated parts shall be replaced prior to start-up by the Contractor at his own expense.

1.23 VIBRATION TESTING

A. Unless specified otherwise in the detailed equipment specifications, each pump, blower, compressor, motor, or similar item of stationary rotating equipment having a rated power in excess of 50 hp or an operating speed in excess of 1,800 rpm shall be tested in the field for acceptable vibration levels. Vibration testing shall be performed by an experienced, factory-trained and authorized vibration analysis expert (not a sales representative) retained by the Contractor for this work. Each unit or pump system shall be tested separately without duplicate equipment running. All field testing shall be done in the presence of the Engineer. The Engineer shall be furnished with four (4) certified copies of vibration test data for each test performed.

1.24 PRESSURE AND TEMPERATURE GAUGES

A. The Contractor shall furnish a compound liquid-filled pressure/vacuum gauge on the suction and a liquid-filled pressure gauge on the discharge of each pump, compressor, and blower. Gauges shall be 4 to 5 inches in diameter with phenolic cases and clear shatter-proof lenses. Gauges shall have a white background and black pointers and characters. Maximum scale reading shall be approximately twice the maximum operating pressure of the fluid being measured. Accuracy shall be $\pm$2 percent. The operating mechanism shall be

of the Bourdon type with positive protection against any solids contamination of the operating mechanism provided. Pressure gauges shall be provided with NPT connections and shall be isolated from the liquid inside the piping with isolating diaphragm seals and gauge cocks. Pressure gauges on rotary or reciprocating equipment shall be provided with pressure snubbers.

B. Unless otherwise specified, the Contractor shall furnish a bi-metallic temperature gauge on the discharge of each air compressor or blower. Temperature gauges shall be approximately 5 inches in diameter with stainless steel case and white background and black pointers and characters. All temperature gauges shall have a range of 0-250°F unless otherwise required for process conditions. Accuracy shall be ±1 percent. Temperature gauges shall be furnished with stainless steel thermowells and NPT connections.

C. Pressure gauges for steam service shall have stainless steel case and shall be equipped with pigtail siphon.

1.25 LIMIT SWITCHES AND SENSORS

A. Unless otherwise specified, limit switches on equipment shall be of the heavy-duty, precision type with NEMA 4 steel enclosure and standard pretravel lever or plunger operator as required. Limit switches shall have SPDT or DPDT contacts rated not less than 5 amps inductive, 10 amps resistance at 120 volts AC. Limit switches in hazardous locations shall be enclosed in a cast aluminum, explosion-proof enclosure.

B. Unless otherwise specified, pressure switches shall be of the snap-acting type with internal adjustment and shock-resistant, cast, waterproof enclosure. Contacts shall be SPDT or DPDT rated minimum 15 amps at 125 volts AC. Switch operation shall be by means of a teflon diaphragm or a Type 316 stainless steel bellows, depending on pressure range. All wetted parts shall be of brass or stainless steel. Switch shall have a repeatability of ±1 percent of range or better. Switch shall be UL listed.

C. Unless otherwise specified, temperature switches shall be of the non-indicating, snap-acting type with internal adjustment, oil-filled stainless steel sensing bulb, and shock resistant, cast watertight enclosure. Contacts shall be SPDT or DPDT rated minimum 15 amps at 125 volts AC. Switch shall be furnished with a separable stainless steel well. Switch shall be UL listed.

1.26 INSTALLATION CHECK

A. An experienced, competent, and authorized service representative of the manufacturer of each item of equipment or other person acceptable to the Engineer shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall be present when the equipment is placed in operation 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 the Engineer.

B. Each equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and (4) has been operated under full load conditions and that it operated satisfactorily. The work described under these Contract Documents will not be accepted as complete until satisfactory installation certifications have been submitted in accordance with the requirements of this section.

C. The Contractor shall properly coordinate the visits by the manufacturer's representatives, particularly where the operation of an item of equipment is dependent on the operation of other equipment. Prior to calling the manufacturer's representative, the Contractor shall ensure that all necessary related equipment, structures, piping, and electrical work is complete. The Contractor shall pay for any revisits to the site by the manufacturer's representative made necessary due to the Contractor's failure to properly coordinate the visits.

D. The Contractor shall inform the Engineer of any impending visits of manufacturer's representatives at least 72 hours before the visits so that the Engineer can make arrangements to have his representative at the site to witness the installation check of the manufacturer's representative.

E. The Contractor shall secure the services of the manufacturer's representative at the site of the work for as long as is necessary to check the installation and place the equipment in satisfactory operation.

F. Electrical connections to equipment shall be made only upon approval of the manufacturer's representative.

G. All costs for this work shall be included in the Contract Prices(s) and no separate payment will be made.

1.27 FIELD TESTING

A. After installation and checkout, all equipment shall be field tested. During the field tests, the equipment shall be subjected to various full load and partial load conditions and emergency operating and shutdown conditions. The ability of the equipment to operate in the prescribed manner without overheating, jamming, excessive noise or vibration, or evidence of excessive wear shall be demonstrated to the satisfaction of the Engineer.

B. All equipment shall be tested before it is covered or insulated. All accessory equipment which may be damaged by conditions during the test shall be isolated or otherwise protected.

C. Should results of the tests indicate that the equipment has failed to perform in accordance with requirements of the applicable detailed equipment specification, in the opinion of the Engineer, the Contractor shall make at his own expense such modifications or adjustments as required for satisfactory operation, including replacement of any or all components, if necessary. Following the modifications or adjustments, the Contractor shall repeat the field tests as specified herein. This procedure shall be repeated until results of the field tests indicate that the equipment has satisfied the requirements of the applicable specification section.

D. The cost of all field testing shall be included in the Contract Price(s) and no separate payment will be made.

1.28 IDENTIFICATION OF PIPING AND EQUIPMENT

A. All piping and equipment shall be identified as follows:

1. All equipment and piping specified to be painted shall be color coded. The colors shall be as specified in Section 09 00 00, Painting. Insulated piping shall be identified using plastic bands, arrows, and letters, colored and sized in accordance with Section 09 00 00, Painting.

2. All major items of equipment shall have an identification nameplate. The Contractor shall submit a suitable list of all items of major equipment to the Engineer, who will furnish the Contractor with an identification numbering system. The nameplates shall be of Type 304 stainless steel, No. 6 finish, and not less than No. 16 gauge with indented stamped lettering. Nameplates shall be attached to equipment bases in easily visible and accessible locations. Nameplates shall be fastened in a permanent manner, arranged not to damage the equipment, with not less than four stainless steel fasteners. All nameplates shall contain as a minimum the following information, where applicable:

a. Name of equipment (from equipment specifications)

b. Manufacturer

c. Model designation

d. Rated horsepower

e. Service factor

f. Electrical and insulation specifications

g. Speed (rpm)

h. Capacity and head (discharge pressure)

i. Net weight

1) Lettering shall be upper case, block style in size and spacing to suit the nameplate. A sample nameplate including fastenings shall be submitted to the Engineer for approval prior to manufacture of any of the nameplates. The identification nameplates shall not be painted.

3. All valves shall be identified with a round brass disc, approximately 1½ inches in diameter and not less than No. 14 gauge, coated with a clear lacquer. Discs shall be fastened to valves in a permanent manner; however, attachment by chain to handwheels or other operators shall not be acceptable. Discs shall be stamped using indented numerals and/or letters with a valve number corresponding to its identification number in the valve schedule to be included in the Operation and Maintenance Manual.

4. All pushbutton stations, switches, motor controllers, transmitters, and other control equipment shall have identification nameplates of the engraved, laminated plastic type affixed to or adjacent to the switch, pushbutton station, etc.

5. All manufacturer's nameplates, identification nameplates, and ASME code plates located on areas of equipment to be insulated shall be removed and reattached on uninsulated areas in a manner acceptable to the Engineer and in his presence.

1.29 WARNING SIGNS

A. Permanent warning signs shall be furnished and installed on all mechanical and electrical equipment where a hazard exists as specified herein. Signs shall be made in accordance with OSHA requirements and shall be suitable for exterior use. Mounting details shall be in accordance with manufacturer's recommendations; location as approved by the Engineer. Fasteners shall be stainless steel.

B. Warning signs shall be approximately 10 inches high by 14 inches wide, colored yellow and black, on minimum 0.080-inch aluminum stock.

** END OF SECTION **

SECTION 46 31 53
OZONE GENERATING AND FEED EQUIPMENT

1 GENERAL

1.1 SUMMARY

A. Design, fabricate, deliver, inspect, test and furnish the ozone generation system, including all items necessary as a complete system for the purpose of pre-oxidation and disinfection of raw water as indicated in the Contract Documents. Equipment includes, but is not limited to, ozone generator equipment, control systems, instrumentation, accessories, and equipment to provide a complete and functional system within the limits identified.

B. The Ozone System Supplier (OSS) shall furnish and commission the ozone system as described in the Contract Documents, inclusive of all associated equipment, instrumentation, scope-specific piping systems, controls, and integration. The OSS shall supply all ancillary supporting equipment as indicated in the Contract Documents for a single source responsibility of the ozone system described herein, unless otherwise specified.

C. The OSS shall coordinate with the Contractor and Engineer during installation, equipment checkout, and testing as necessary to ensure a complete, functional system.

D. This Specification and the Contract Document package outline expected performance requirements and design aspects for the system specific to its role in the overall project. However, it is not the intent of these Contract Documents to detail all process, mechanical, electrical, controls and related supporting System requirements. The OSS shall design and supply all components necessary for the successful automatic operation of the System to meet the performance requirements established herein. Should the OSS find it necessary or desirable to deviate from specific design aspects detailed in the Contract Documents to meet the performance requirements, the OSS shall clearly state all deviations in the submittals with Contract Document references along with the reason for each deviation.

1.2 SCOPE

A. In general, the OSS shall furnish and deliver the following system components to the project site location. The OSS shall furnish the system components listed below in accordance with the requirements of the Contract Documents. All components shall be shipped fully assembled and ready for installation, unless otherwise noted. Existing equipment not included in the scope of supply defined below shall be subject to inspection in accordance with 2.2 General, subsection C of this specification.

1. Oxygen Filtration Manifold
2. Oxygen Regulation Manifold
3. LOX Booster System
4. Ozone Generation System
5. Master Ozone Control Panel (MOCP)
6. Spare Parts

1.3 REFERENCES

A. The organizations listed below form a part of this Specification to the extent referenced. The publications are referred to within the text by the basic designation only. Unless otherwise noted, the most recent version of the listed publications, including revisions, at the time of bid opening shall apply.

1. American Welding Society (AWS)
2. American Society of Mechanical Engineers (ASME)
3. ASTM International (ASTM)

4. Compressed Gas Association (CGA)
5. International Society of Automation (ISA)
6. Environmental Protection Agency (EPA)
7. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
8. National Electrical Manufacturers Association (NEMA)
9. National Fire Protection Association (NFPA)
10. NSF International (NSF)
11. Underwriters Laboratories (UL)
12. Compressed Gas Association (CGA)

1.4 SHOP DRAWINGS AND ENGINEERING DATA

A. Mechanical Equipment Engineering Submittal

1. The OSS shall submit for review and approval a comprehensive Mechanical Equipment Engineering Submittal. The Mechanical Equipment Engineering Submittal shall contain the following documentation, at a minimum:
    a. Shop Drawings
        1) Shop Drawings shall show layout and dimensions of equipment, major components, key alignment locations and locations of bolt holes. Drawings shall also indicate where access points for maintenance and operations are located on the equipment. Drawings shall show critical dimensions identified by the OSS.
        2) The submitted Shop Drawing package shall show the entire scale of the proposed System. The submitted drawing package shall be coordinated and oriented in conjunction with the preliminary floor plan layout as shown in the Contract Document package.
        3) Process and Instrumentation Diagrams (P&IDs) showing all equipment and instrumentation which will be controlled by the Ozone System Master Control Panel, including components provided by others. P&IDs shall differentiate which components are supplied by others. The OSS shall establish a preliminary tagging scheme for the P&IDs. Tagging scheme will assign a unique tag to all components and their associated I/O. Tagging scheme shall organize components by “Process System”.
        4) All shop drawings shall be stamped and signed by a Georgia Registered Professional Engineer.
    b. Design Documentation and Calculations
        1) Seismic Anchorage Calculations for all equipment.
        2) All calculations shall be stamped and signed by a Georgia Registered Professional Engineer.
    c. Product Technical Documentation
        1) Product data shall include Manufacturer's descriptive data, technical literature, performance charts, performance curves, catalog cuts, and related information. Include product data for each different item of material and equipment specified. Provide the total weight of the equipment including motors and appurtenances.
    d. Certificates
        1) NSF 61 Listing for equipment in contact with drinking water.
2. All documentation shall be submitted in digital PDF format. Hardcopies are not required.

3. The OSS shall not proceed with the equipment procurement and fabrication phase of the project without prior approval of the Mechanical Equipment Engineering Submittal by the Engineer.

B. Electrical Equipment Engineering Submittal

1. Following the approval of the Mechanical Equipment Engineering Submittal, the OSS shall submit for review and approval a comprehensive Electrical Equipment Engineering Submittal. The Electrical Equipment Engineering Submittal, at a minimum, shall contain the following documentation:

a. Shop Drawings

1) Submit drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the System has been coordinated and will properly function as a unit. Shop Drawings shall show proposed layouts and anchorage of equipment and appurtenances as well as equipment relationships to other parts of the system including clearances for maintenance and operation. A complete listing of equipment and materials shall also be provided.

2) All shop drawings shall be stamped and signed by a Georgia Registered Professional Electrical Engineer.

b. Control Write-up

1) A comprehensive control write-up describing the operation of the ozone system shall be provided.

2) The control write-up shall reiterate and further describe all the controls and functionality of the system as described in this specification.

c. Product Technical Documentation

1) Product data shall include Manufacturer's descriptive data, technical literature, performance charts, performance curves, catalog cuts, and related information. Include product data for each different item of material and equipment specified.

2. All documentation shall be submitted in digital PDF format. Hardcopies are not required.

3. The OSS shall not proceed with the equipment procurement and fabrication phase of the project without prior approval of the Electrical Equipment Engineering Submittal by the Engineer.

1.5 QUALITY ASSURANCE

A. All equipment described herein shall be supplied by a single Ozone System Supplier (OSS). The Ozone Generator Manufacturer shall be regularly engaged in furnishing similar equipment for use in water treatment plants and shall have five (5) systems in satisfactory operation for at least three (3) years.

B. The Ozone Generator Manufacturer shall provide an installation list of at least five (5) similar installations in the United States, including contact names and phone numbers. Equipment shall be supported by a service organization that is reasonably convenient to the site to ensure parts and service can be acquired in a timely fashion. The installations shall meet the following “minimum” criteria to be considered acceptable:

1. Have municipal drinking water installations subject to State and Federal drinking water regulations.

2. Installations shall utilize similar operational strategies to those specified herein.

3. If the Ozone Generator Manufacturer cannot provide the required number of installations within the United States, provide a complete list of installations within the United States and provide a minimum of ten (10) similar installations world-wide.

C. Equipment Supplier’s Statement

1. Submit a statement by the OSS listing any exception to or deviations from the Contract Drawings and Specifications. Written evidence that equipment and accessories are a product of a qualified and experienced Manufacturer. Statement indicating the System can provide ozone according to the conditions stated herein.

D. Ozone System Supplier's Representative

1. Provide services of a qualified Ozone System Supplier's Field Representative experienced in the installation, adjustment, and operation of the equipment furnished and who has complete knowledge of the proper operation and maintenance of the System. Include a statement indicating the operators designated to train the on-site operators have been trained to operate the installed equipment.

E. Certifications

1. All products in contact with potable water shall be NSF / ANSI Standard 61 certified. Those product types for which an NSF / ANSI Standard 61 certification is not available shall be constructed entirely of 316L stainless steel material.
2. All control panels shall be built and assembled to UL 508A standards and bear the UL 508A Industrial Control Panel label.

F. Welding of Fabricated Items

1. Perform welding following AWS qualified procedures, using performance-qualified welders and welding operators. OSS shall furnish a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators to the Engineer upon request.

1.6 STORAGE AND PROTECTION

A. Materials shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.7 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

2 PRODUCTS

2.1 OZONE SYSTEM SUPPLIER

A. The specifications and project drawings depict the design, equipment, and materials as supplied by Pureflow Ozone Division of California Environmental Controls, Inc., Whittier, CA 90601; are deemed most suitable based upon past performance and are intended to constitute a standard for quality and performance most suitable for the application and service anticipated. All Ozone System Suppliers (OSS) shall prepare their bid based on the specified equipment for determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.

B. After execution of the contract, the Contractor may offer substitutions to the specified equipment, for consideration. The equipment proposed for substitution must be superior in construction and equal in performance to that specified in the contract. The higher quality must be demonstrated by providing detailed submittal documentation and a list of current users of the proposed equipment with similar installations and water quality. The list must include raw and ozonated water quality, verified by an independent certified laboratory, and customer's contact name / title and telephone number.

C. In the event the Contractor wishes to obtain Engineer's approval for equipment substitution, the Contractor shall, at their own expense, make all resulting changes to the enclosures, buildings, piping, civil work (including seismic calculations), electrical and tankage systems that are required to accommodate the proposed filtration equipment. Revised detailed drawings, new specifications and cut-sheet information illustrating the substituted equipment shall be submitted to the engineer prior to acceptance.

D. It shall be assumed that if the cost to the Contractor is less for the proposed substitution, then the contract price shall be submitted to the engineer prior to acceptance.

2.2 GENERAL

A. The OSS shall coordinate with the Engineer on connection types, connection sizes, power requirements, operational clearances, maintenance clearances, etc. for all equipment provided in the OSS scope of supply.

B. Unless otherwise specified or indicated in the Contract Documents, interconnecting piping, valves, supports, and related appurtenances will be provided by the Contractor.

C. The OSS shall inspect existing equipment that is anticipated for use with the new ozone generation system. The inspection report will be provided to the Engineer for review.

1. If any equipment is reported by the OSS as inadequate, the Engineer and the Contractor shall be responsible for improving the inadequacies specified by the OSS to make the existing equipment compatible with the new ozone generation equipment.

2. If any equipment is reported by the OSS as incompatible, the engineer and the OSS shall be responsible for identifying suitable, new equipment to replace the existing equipment.

a. The OSS shall state in the report whether the incompatible equipment shall also be supplied with the new ozone generation system under a change order.

b. The installation contractor shall install any new equipment added under change order by the OSS.

c. The Engineer shall integrate any new equipment added under change order by the OSS into the overall ozone system design including but not limited to mechanical and electrical disciplines.

2.3 DESIGN CONSIDERATIONS

A. The ozone generation and feed system shall be designed with the following design considerations.

Design Parameter	Minimum	Maximum
Site Elevation (feet)	700	1,000
Outdoor Ambient Air Temperature (°F)	-20	110
Indoor Ambient Air Temperature (°F)	60	80
Indoor Ambient Air Humidity (%)	40	70
Raw Water Temperature (°F)	38	78
Raw Water Flowrate (MGD)	1.0	35.0
Operating [Motive] Pressure (psig)	5	80
Supply [Ozone Gas] Pressure (psig)	30	40
Raw Water Ozone Demand, Applied (mg/L)	0.5	10

B. Firm Capacity Design

1. Capacity will be provided in all Systems that is sufficient to meet the values stated below with the largest unit offline, a sizing strategy referred to as Firm Capacity. For example, if one unit is required to meet a stated value, a second redundant unit is required. If ten (10) units are required to meet the stated value, an eleventh (11th) unit is required.

2. The System will be sized for Firm Capacity with the following restrictions on the number of units for each System.

3. Firm Capacity only applies to the ozone generators. All other equipment included in this specification shall be supplied in the quantities defined in the table below.

Item	Minimum Number of Units	Maximum Number of Units
Oxygen Filtration	1	1
Oxygen Regulation	1	1
Ozone Generator	1	2
Lox Booster	1	1
Ozone System Master Control Panel	1	2

2.4 OZONE GENERATION SYSTEM

A. Ozone Generator

1. Design Requirements

a. The ozone generator system shall meet the following design requirements:

Total Design Requirement	Value
Ozone Production Capacity @ 14% by weight (lbs/day)	122
Ozone Production Capacity @ 10% by weight (lbs/day)	150
Applied Dose Capacity @ 14% by weight (mg/L)	0.67
Applied Dose Capacity @ 10% by weight (mg/L)	0.82

2. General

a. The ozone generator technology shall be modular dielectric barrier discharge type.

b. Power Requirements: 480 VAC / 3ph / 60Hz. If required, a step-down transformer can be used to convert 480 VAC to the necessary voltage.

c. A generation module shall be defined as one (1) individual, fully independent, ozone generation reactor paired with one (1) individual dedicated power supply.

d. Each ozone generator shall include a common internal power distribution system, common communication / controls, a common oxygen supply manifold, a common ozone outlet manifold, and a common cooling water inlet / outlet manifold, integrating all the ozone generation modules.

e. Each ozone generator shall utilize the structural support frame as a common manifold for the distribution of oxygen and cooling water supply to the ozone generation reactor, and a manifold for collection of ozone and the return of cooling water. Both the reactor(s) and power supply(s) shall be directly mounted to the frame. The use of tube fittings, tubing, and threaded connections internal to the ozone generator for the transmission of such media shall not be allowed.

f. The ozone generator and all its components shall be rated to operate at an ambient room temperature of 100°F at 70 percent relative humidity.

g. The ozone generator shall be water cooled. The use of air-cooled ozone generators shall not be allowed.

h. In the event of an ozone generation reactor or a power supply failure, all remaining reactors and power supplies shall continue producing ozone. In the event of such failure, the reduction in maximum ozone output capacity shall not exceed 3%.

i. The generator shall be designed to operate at internal gas pressures up to 45 psig and supply ozone at pressures up to 40 psig.

j. The generator shall operate with a power factor of 0.95 or higher across the full ozone generator production capacity range.

k. All materials used in the transmission of, and in contact with, ozone shall be stainless steel, anodized aluminum, or PTFE.

l. The ozone generator shall be manufactured by Primozone, GM Series, or Engineer approved equal.

3. Generator Enclosure

   a. The ozone generator shall be comprised of an enclosure with an internal platform that will accommodate a plurality of ozone generation modules.

   b. The ozone generator, in its standard configuration, shall operate at a maximum sound level of 55 dBA at 3 feet. This shall be achieved without the addition of any form of sound mitigating device (muffler, sound attenuating enclosure, etc.).

   c. The enclosure shall have two (2) access panels or doors on opposing sides to access the power supplies and reactors from two (2) sides.

   d. The enclosure shall be manufactured from stainless steel with a polished finish. The door of the enclosure shall incorporate a clear see-through panel. Enclosures constructed from painted carbon steel shall not be allowed.

4. Ozone Generation Reactor

   a. Each ozone generation module shall produce a maximum of 3 lbs / per day at 10% ozone by weight.

   b. The reactor shall be double-sided, flat, and made of stainless steel, anodized aluminum, and ceramic materials.

   c. The reactor shall incorporate cooling water on both sides of the electrode.

5. Power Supply

   a. Each ozone generation module shall be provided with an individual, fully independent power supply for each ozone generation reactor.

   b. Power Requirements: 480VAC / 3pH / 60Hz. Each power supply shall be powered via the ozone generator control panel.

   c. The power supply shall operate at a minimum output frequency of 40 kHz.

   d. The power supply shall include two (2) internal temperature sensors.

   e. All power supplies shall be installed inside the ozone generator enclosure. Ozone generation systems incorporating power supply units external to the ozone generator shall not be allowed.

6. Controls and Communication

   a. The ozone generator shall be equipped with an integrated dedicated control panel.

   b. The ozone generator control panel shall be capable of sending and receiving signals and commands from the Ozone System Master Control Panel. This communication shall be via Modbus TCP.

   c. The ozone generator control panel shall incorporate an elapsed run-time counter. The counter shall only be resettable by a Manufacturer Authorized Representative.

   d. All control circuits shall use 24VDC power produced by an internal transformer or power supply.

   e. The ozone generator shall include automatic ramping of power to limit the rate of change of power to each power supply.

   f. The power supply shall shut down automatically if either of the two (2) internal temperature sensors indicates a temperature above the operating limit. The power supply shall report an error message to the ozone generator's PLC communicating such an event.

g. Each individual power supply shall be a self-regulating, circuit monitoring system which measures frequency, current, voltage and power. The measurements shall be locally communicated through the ozone control panel screen (HMI).

h. Controls shall be provided to remotely monitor and adjust ozone production rate and ozone concentration. Power consumption and oxygen feed gas flow shall be automatically regulated to achieve the set ozone production rate and ozone concentration.

i. Each Ozone Generator shall include an independent Programmable Logic Controller (PLC) based Ethernet-ready control system. The PLC shall be manufactured by Schneider Electric or Engineer approved equal.

j. A Human Machine Interface (HMI) shall be provided for status monitoring and control. The HMI shall be manufactured by Schneider Electric or Engineer approved equal.

k. The control panel enclosure shall be manufactured by Rittal Corporation or Engineer approved equal.

B. Backflow Protection Device

1. The OSS shall provide a system protecting the backflow of process water via the mass transfer system from entering the ozone generator.
2. One (1) dedicated backflow protection device shall be provided for each ozone generator.
3. The manufacturer of the backflow protection device shall be the same manufacturer as the ozone generator. Backflow protection devices manufactured by a third party shall not be allowed.
4. The device shall be designed for inline installation on the ozone gas discharge line of the ozone generator with NPT type connections.
5. The manufacturer shall provide a backflow protection device shall be rated for the full design flow capacity of the ozone generator.
6. The device shall include automatic control of both a water detecting sensor and a shut-off valve. The device shall be directly connected to, and interlocked with, the ozone generator. Devices not directly integrated with the ozone generator shall not be allowed.
7. The device shall be powered by one (1) 24 VDC connection derived from the ozone generator. Pneumatic activated devices shall not be allowed.
8. The electrically actuated shut-off valve shall be a fast-acting solenoid with stainless steel body and PTFE seat. All wetted parts shall be 316L SS, PTFE, or anodize aluminum.
9. The water detecting sensor shall be capacitive type with an adjustable sensitivity setting. The sensor housing shall with PTFE material.
10. Both the water detecting sensor and the shut-off valve shall be shrouded in a removeable thermoplastic cover.
11. The backflow protection device shall be manufactured by Primozone, BFP Series or Engineer approved equal.
12. A second shut-off valve shall be provided downstream of each backflow protection device. The valve shall open when the ozone generator is in service and close when the generator is placed on stand-by. The device shall automatically close upon loss of power – i.e., fail-closed type.
13. A third shut-off valve shall be provided downstream of each backflow protection device. The valve shall close when the ozone generator is in service and open when the ozone generator enters a purge cycle to the ozone destruct unit. The device shall automatically close upon loss of power – i.e., fail-closed type.

2.5 OXYGEN SUPPLY SYSTEM

A. Design Requirements

1. The oxygen supply system shall meet the following design requirements:

Design Requirement	Value
Flow Output, Maximum (scfh)	1,380
Operating Pressure, Minimum (psig)	30
Operating Pressure, Maximum (psig)	100
Oxygen Concentration, Minimum (%)	94
Oxygen Gas Dewpoint, Minimum (°F)	-70
Oxygen Velocity (fps)	50

B. General

1. All components and subsystems shall be sized to accommodate the air flows required to operate at the maximum capacity of the ozone generation system.
2. All materials used in the transmission of and in contact with oxygen shall be of 316L stainless steel construction and include gasket or seal material that is compatible with oxygen and/or ozone gas.
3. All materials used in the transmission of and in contact with oxygen shall be stainless steel.
4. The OSS shall be responsible for determining all information required to correctly interface this system with the Master Ozone Control Panel (MOCP).
5. All piping in oxygen service shall be cleaned in accordance with CGA guidelines and specifications.

C. Oxygen Filtration Manifold

1. Minimum Component Requirements
   a. Manual isolation ball valves.
   b. Manual drain / service ball valve.
   c. Temperature indicating gauge or transmitter.
   d. Pressure indicating gauge or transmitter.
   e. Particulate filter assembly including a removable filter element (0.01-micron rating).
   f. Pressure safety valve

D. Oxygen Regulation Manifold

1. Minimum Component Requirements
   a. Manual isolation ball valves.
   b. Manual drain / service ball valve.
   c. Temperature indicating gauge or transmitter.
   d. Pressure indicating gauge or transmitter.
   e. Dewpoint transmitter.
   f. Pressure regulating assembly.
   g. Pressure safety valve

E. LOx Booster System

1. Minimum Component Requirements
   a. Manual isolation ball valves.

b. Particulate filter assembly including a removable filter element (course 5-micron rating).

c. Particulate filter assembly including a removable filter element (fine 1-micron rating).

d. Particulate filter assembly including a removable filter element (polish 0.01-micron rating).

e. Air dryer with LCD display.

f. Pressure indicating transmitter.

g. Mass flow controller.

2.6 CONTROLS

A. The Ozone Generation System controls shall consist of both local controls for individual components, and a Master Ozone Control Panel for sequencing and control of multiple ozone generators and appurtenant systems as well as an interface with the facility's SCADA System.

B. Master Ozone Control Panel

1. A Master Ozone Control Panel shall be supplied with the ozone generation and feed system.

2. The Master Ozone Control Panel will provide monitoring and control of the ozone systems. Changes in operating conditions for all major equipment shall be accomplished locally from each sub-system or from the Master Ozone Control Panel.

3. The control panel shall be built and assembled to UL 508A standards and bear the UL 508A Industrial Control Panel label. The panel shall be assembled directly by the ozone system supplier.

4. At a minimum, controls shall be provided to remotely monitor and adjust ozone production rate, power consumption, ozone output concentration, and oxygen feed gas flow. Remote monitoring of oxygen pressure, dew point temperature, cooling water flow and cooling water temperature is required.

5. All parameters monitored or computed by the Master Ozone Control Panel shall be available for continuous output to the WTP SCADA system for real-time display, storage, and trend analysis.

6. The control system shall be protected from power surges and variations in power supplied to the equipment. The OSS will provide an Uninterruptable Power Supply dedicated for the Master Ozone Control Panel sized for a minimum 30-minute run time.

7. Schematics and interconnecting wiring diagrams shall be provided for power, control, and instrumentation circuits. Control power transformers, relays, adjustable timers, auxiliary contacts, switches, or additional equipment to interconnect the generator to other auxiliary equipment and the Master Ozone Control Panel, and control circuits as shown on schematic or instrument control drawings shall be provided.

8. The Master Ozone Control panel shall be mounted on the ozone generator skid and be fully assembled with all wiring between it and the Ozone Generator Control Panel completely installed and tested for proper operation and control.

9. Programmable Logic Controller (PLC)

a. The programmable logic controller shall be either CompactLogix or ControlLogix as manufactured by Allen Bradley, or Engineer approved equal.

10. Human Machine Interface (HMI)

a. The human machine interface shall have a 12" display (minimum) and shall be manufactured by Allen Bradley, or Engineer approved equal.

11. Enclosure

a. The Master Ozone Control Panel shall have a NEMA Type 3R enclosure rated for outdoor use.

b. The panel enclosure shall be manufactured by Rittal Corporation, or Engineer approved equal.

C. Ozone Generator Control [Ozone Production] Strategies

1. The Ozone Generator(s) must be capable of fully automatic operation in all of the following modes.

2. The Ozone Generator(s) will allow operation in the following modes:

a. Constant Ozone Concentration-Variable Gas Flow Rate

1) Set a constant concentration of ozone in gas to between 10%-20% by weight.

2) Vary gas flow rate to modulate ozone production output.

b. Variable Ozone Concentration-Constant Gas Flow Rate

1) Set a constant gas flow rate.

2) Vary the concentration of ozone in gas to between 5%-20% by weight to modulate ozone production output.

c. Constant Ozone Concentration-Distributed Gas Flow Rate

1) Set a constant concentration of ozone in gas between 10%-20% by weight.

2) Utilizing an external (distributed) mass flow controller, vary gas flow rate to modulate ozone production output.

a) No gas flow [production] control is applied by the ozone generator to the oxygen/ozone mixture. Gas flow control is strictly controlled by an external device.

b) The ozone generator shall automatically and proportionally ramp power, according to the gas throughput measured by the ozone generator's on-board mass flow meter, to maintain constant concentration of the ozone gas.

D. Master Ozone Control Panel [Water Treatment] Strategies

1. The Ozone Generation System must be capable of turnkey, fully automatic operation. Fully automatic operation includes one-touch start [and stop] of the ozone system equipment sequencing required to treat water.

2. The following operational modes and their respective user settable inputs, including start and stop of the ozone system, shall be controlled locally (at the Master Ozone Control Panel) or through a remote-control location such as the plant's Control Room.

3. The Master Ozone Control Panel will allow operation in the following modes:

a. Manual Control Mode includes a user settable ozone production output that will deliver a constant rate of ozone production in pounds per day (lbs / day).

b. Flow Pace Mode includes a user settable dosing output that will apply a constant dose of ozone in mg/L to a variable flow of motive water.

1) The Master Ozone Control Panel shall integrate plant analog signals, as needed, to proportionally adjust production.

c. Residual Control Mode includes a user settable residual target in mg/L that will deliver ozone production to maintain a constant dissolved residual ozone target value at a user selectable target analyzer.

1) The Master Ozone Control Panel shall integrate plant analog signals, as needed, to proportionally adjust production.

E. Alarms and Interlocks

1. Alarms and interlocks shall be provided to ensure proper operation of the ozone generators. A shutdown command shall be issued to unsafe or improper conditions that may exist as noted below.
2. The following section lists the minimum amount of alarm conditions and interlocks that will be monitored by the Local Control Panel and transmitted to the Master Ozone Control Panel.
    a. Ozone Generator Local Control System
        1) High cooling water temperature alarm
            a) Shutdown command issued by local controller.
        2) Low cooling water flow alarm
        3) High inlet gas pressure alarm
            a) Shutdown command issued by local controller.
        4) Low inlet gas flow alarm
        5) Backflow protection device triggered alarm.
            a) Shutdown command issued by local controller.
        6) Power supply status alarm
        7) Power supply communication error alarm
        8) Emergency Stop
            a) Shutdown command issued by local controller.
        9) External Modbus communication error alarm
            a) Programmable responses include: continue production, controlled stoppage or emergency stoppage.
    b. Oxygen Filtration and Regulation Manifolds
        1) High pressure alarm.
        2) Low pressure alarm.
        3) High dewpoint alarm.
    c. LOx Booster System
        1) High dewpoint alarm
        2) Dryer general alarm
    d. Plant [Existing] Alarming shall include but not be limited to:
        1) General plant alarm
        2) Emergency alarm
        3) Major equipment feedback

2.7 SPARE PARTS

A. The OSS shall provide the following components, at a minimum, as spare parts:
    1. One (1) Ozone Generation Reactor
    2. One (1) Power Supply
    3. One (1) Gas Flow Proportional Valve
    4. One (1) Temperature Sensor (Coolant)
    5. One (1) Pressure Sensor (Gas)
    6. One (1) set of Oxygen Filtration System Filter Elements
    7. One (1) Ozone Destruct Unit Heating Element

8. One (1) set of Ozone Destruct Unit Destruct Catalyst Media

3 EXECUTION

3.1 DLEIVERY, STORAGE, AND HANDLING

A. The OSS shall provide shipping from the factory to the project site location. The Contractor shall provide offloading of all equipment once it is delivered to the project site.

B. Factory assembled equipment shall be skid mounted, and crated to protect against damage during shipment. Factory assembled parts and components shall not be dismantled for shipment. The Contractor shall not be required to do any jobsite assembly of package Systems. No disassembly of any factory assembled components shall occur without the Ozone System Supplier's written approval and presence onsite.

C. Finished surfaces of all exposed inlets and outlets of equipment shall be protected with secure caps, blind flange, or other device, as necessary to prevent ingress of contaminants. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion. All equipment delivered to the site shall be stored in accordance with the Manufacturer's instructions. Electrical equipment shall be stored in weatherproof, ventilated enclosures.

D. All spare parts shall be packed in containers bearing labels clearly designating the contents and respective pieces of equipment for which they are intended. All spare parts shall be delivered at the same time as the pertaining equipment.

E. Equipment shall be stored in a weather tight location and all items shall be kept thoroughly dry at all times.

F. System Receiving and Handling Documentation

1. The OSS shall submit instruction pertaining to the receiving and handling of the equipment. Instruction shall be provided for all components of the Ozone System.
2. The OSS shall submit the instruction documentation to the Contractor and Engineer no later than two (2) weeks prior to the delivery of the Ozone System.
3. All documentation shall be submitted in digital format. Hardcopies are not required.

3.2 INSTALLATION

A. The Ozone System Supplier (OSS) shall not be responsible for installation of any equipment. These services shall be provided by the Contractor.

B. The Contractor shall be responsible for oxygen cleaning of all new and existing piping in oxygen service other than piping provided by the OSS. Oxygen cleaning shall be in accordance with CGA guidelines and specifications.

3.3 PRE-STARTUP INSPECTION

A. The OSS shall provide a Manufacturer qualified service representative for on-site inspection services prior to the startup of the system.

B. Pre-startup services shall include one (1) trip with a total of three (3) days onsite. All expenses associate with such services (travel, room and board, incidentals, etc.) shall be the responsibility of the OSS.

C. It shall be the responsibility of the Contractor to coordinate the scheduling of the pre-startup services.

3.4 STARTUP, COMMISSIONING, AND TESTING

A. The OSS shall provide a Manufacturer qualified representative for startup and commissioning services for the OSS provided equipment.

B. Prior to mobilizing on-site for startup, the OSS shall submit a pre-startup checklist to the Contractor. The Contractor shall confirm all items on the checklist are complete and sign and date the checklist before the startup is officially scheduled.

C. Startup and commissioning shall consist of two (2) trips with a total of ten (10) days onsite. All expenses associate with such services (travel, room and board, incidentals, etc.) shall be the responsibility of the OSS. OSS shall provide subsequent trips for the required durations until the system is successfully started up, tested, and commissioned.

D. System Start-up and Commissioning Documentation

1. The OSS shall submit documentation pertaining to the startup and commissioning of the equipment. Documentation shall be provided for all components of the Ozone System.
2. The OSS shall submit the startup and commissioning documentation to the Contractor and Engineer no later than two (2) weeks prior to the scheduled startup of the Ozone System.

3.5 TRAINING

A. Upon successful commissioning of the system, the OSS shall provide a Manufacturer qualified representative for operations and maintenance training.

B. Preliminary ozone system training shall consist of one (1) four-hour classroom session before commissioning begins and one (1) four-hour classroom session during the commissioning phase. Training shall coincide with the trip required for start-up and commissioning.

C. The final ozone system training sessions shall include one (1) four-hour classroom session, one (1) four-hour hands-on training session, and one (1) four-hour preventative maintenance session on-site after commissioning is complete. These training sessions will occur on-site and coincide with the trip required for start-up and commissioning.

D. Training Documentation

1. All literature, materials, presentations, etc. required for adequate operator training shall be supplied by the OSS.
2. The OSS shall submit training documentation to the client no later than two (2) weeks prior to the scheduled operator training.

3.6 SYSTEM SIGN-OFF AND PROJECT CLOSEOUT

A. Closeout Documentation

1. The OSS shall submit certification that the equipment, as installed, meets the operating points given under the Process Design Conditions section and as presented in the Manufacturer's proposal.
2. As-built Documentation
   a. Upon completion of installation, startup and commissioning, the OSS shall inspect the completed installation for deviations from the original design. All realized deviations shall be incorporated into the design documentation.
   b. All revised documents previously provided as part of the Installation, Operation and Maintenance Documentation shall be reissued in the form of an addenda with detailed instruction on incorporating the revised documentation into the manual.

3.7 OPERATION AND MAINTENANCE

A. Installation, Operation, and Maintenance Documentation

1. The OSS shall submit installation, operation, and maintenance documentation for the system as a whole, and for the individual components of the system. Documentation shall be provided for all components of the Ozone System.
2. The OSS shall submit the installation, operation and maintenance documentation to the Engineer and Contractor no later than two (2) weeks prior to the delivery of the Ozone System.
3. All documentation shall be submitted in digital format for preliminary review. Hardcopies are not required for the preliminary submission.

4. Upon approval of the preliminary Installation, Operation, and Maintenance Manual, the OSS shall resubmit the finalized documentation in both digital format and hard copies. A total of two (2) complete hard copy sets shall be provided.

3.8 WARRANTY

A. The OSS shall provide a full and comprehensive warranty for all equipment included in the System package. The equipment shall be warranted to be free from defects in workmanship, design, and materials for a period of twelve (12) months from the date of Owner acceptance.

B. If any parts of the equipment supplied under this section should fail during the individual equipment Manufacturer's warranty period, replacement of parts or the unit itself shall be provided. The units shall be restored to active working service at no expense to the Owner. The OSS shall incur all costs including but not limited to parts, labor, service, technicians, shipping, and handling required for restoration of equipment to active service as required under the Manufacturer's warranty.

C. All warrantee support, as defined in the warranty statement, shall be provided by the OSS directly or through an OSS authorized representative.

** END OF SECTION **

APPENDIX A

PRIMOZONE QUOTATION

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QUOTATION

TO: John R. Fleck

Engineering Strategies, Inc.
3855 Shallowford Road, Suite 525
Marietta, GA 30062

(770) 634-4177
jfleck@esi-ga.com

DATE:	QUOTE #:	REVISION
3/14/2025	Z2303009	0

SUBJECT: Gees Mill WTP, Rockdale, GA

REFERENCE: Ozone Generator Replacement

WE ARE PLEASED TO OFFER OUR QUOTATION ON THE FOLLOWING

ITEM	QTY	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	Ozone Generator and ancillary equipment, 150 PPD @ 10% by weight, including the following: one (1) Primozone GM48 ozone generator; one (1) Primozone backflow protector; one (1) LOX booster system; instrumentation; PLC based ozone system master control panel, including HMI, PLC, ethernet communication, uninterruptable power supply (UPS); engineering submittals and drawings; operation and maintenance manuals; pre-start-up assistance; start-up and commissioning; and operator training. Please refer to the attached Scope of Supply for a detailed description of the equipment and services included and not included in this quotation.	$ 721,000.00	$ 721,000.00

NOTE: PRICE(S) DOES (DO) NOT INCLUDE ANY TAX UNLESS SPECIFICALLY NOTED

PROGRESS PAYMENT TERMS: see page 2 of 3
APPROX. DATE OF SHIPMENT: TBD
EST. SHIPPING WEIGHT: TBD
F.O.B.: Gees Mill WTP, Rockdale, GA FFA

PUREFLOW FILTRATION DIV.

By Daniel D. Pulliam March 14, 2025

Please sign and return

Accepted by:

Prices specified herein are exclusive of all taxes unless specifically noted
This proposal is subject to all terms and conditions printed on face and reverse side

PROGRESS PAYMENT TERMS

Payment Terms

20% with purchase order or execution of a contract

25% upon delivery of mechanical equipment submittal documentation to the client, contractor, and / or consulting engineer.

30% upon release to procurement / fabrication

20% upon equipment delivery to jobsite or availability for delivery jobsite

5% due upon completion of start-up and commissioning

Pricing Validity

Pricing stated within this quotation shall remain valid for 90 days. Based on current market volatility, Pureflow cannot accurately assess escalation to the pricing stated within this quotation and hold that pricing until March 2026. We do not believe that our pricing will increase greater than 20% between now and March 2026. Therefore, we suggest that you add a 20% contingency to the stated price to cover any possible increase.

Notes

Refer to the attached scope of supply

PUREFLOW FILTRATION DIV. QUOTATION STANDARD TERMS AND CONDITIONS OF SALE

1. AGREEMENT. The terms and conditions set forth below and on the front side hereof constitute the entire Agreement between the customer named on the front side hereof ("Buyer") and Pureflow Filtration Div., and Pureflow Ozone Div., divisions of California Environmental Controls, Inc., a California corporation ("Seller").

2. TERMS OF SALE. (a) TAXES: Unless specifically provided on the front side hereof, prices specified herein on the Goods are exclusive of all local, state, and federal taxes including without limitation taxes on manufacturing, sales, receipts, gross income, occupation, use and all similar taxes, or other taxes of any nature. Wherever applicable, such taxes will be invoiced as a separate charge which Buyer agrees to pay the Seller. (b) TERMS OF PAYMENT: Net cash due upon receipt of invoice, unless noted on front side of this quotation, to approved credit accounts. The Buyer agrees to pay Seller an additional charge of one and one-half percent (1 and 1/2%) per month (or such lesser amount equal to the maximum rate permitted by law) on any invoices not paid according to these terms. (c) SECURITY INTEREST: Until payment in full of the purchase price therein specified, Seller reserves a security interest in the goods securing payment of such purchase price. (d) DELIVERY: Prices quoted are f.o.b. point of origin of shipments unless shipping is specifically included in price offered on front page. Prices include domestic packing for rail or commercial shipments only. Shipment and delivery dates are estimates based upon schedules of Seller's suppliers and are computed from the time of settlement of all details and receipt of full approval of drawings where drawing approval is required. (e) Field Supervision: Unless specifically provided on the front side hereof, no installation assistance or field supervision by Seller is included in the terms and conditions of this Agreement.

3. ENTIRE AGREEMENT. This agreement supersedes all previous representations, statements, promises, agreements or understandings, written or otherwise. This Agreement is intended by the parties as a final expression of their understanding and no casual or prior dealings shall be relevant to explain any of the terms or conditions hereof. The Seller shall not be bound by any agent's or employee's representations, promises, statements or inducements not set forth in the Agreement. If any inconsistency exists between any typed or handwritten materials on the front hereof and these Standard Terms and Conditions, the former shall be controlling.

4. ACCEPTANCE. This quotation is an offer upon the terms and conditions herein specified. Acceptance by the Buyer may be effected by signing a copy of this quotation where specified and returning same to the Seller, or by the Buyer issuing a purchase order and delivering same to the Seller, which shall constitute Buyer's acceptance of this quotation and all of the terms and conditions herein specified. Acceptance of this offer is limited to its terms. Acceptances or confirmation which state additional or different terms from this offer shall be operative as acceptances; provided, however, that all such additional or differing terms shall be deemed material alterations within the meaning of Section 2207 (2) (b) of the California Commercial Code and notice of objection to them pursuant to Section 2207 (2) (c) of the California Commercial Code is hereby given.

5. CANCELLATION. Orders may be cancelled by the Buyer only with Seller's written consent and upon payment of reasonable and proper cancellation charges, including factory costs and expenses.

6. INSPECTION. Buyer agrees to inspect the goods, supplies, merchandise, and material covered hereby ("Goods") immediately upon their receipt by Buyer, secure a written acknowledgement from the delivering carrier as to any loss or damage and within three (3) business days of their receipt to give written notice to the Seller of any claim that the Goods do not conform with the terms of the Agreement. Failure to make such a claim within the stated period shall constitute an irrevocable acceptance of the Goods and an admission that they fully comply with all of the terms and conditions of the Agreement. Buyer expressly waives any right it may have to revoke acceptance after such three (3) day period.

7. DELAYS. Seller shall not be liable for any delays or failures in making shipments or deliveries caused by any contingency beyond Seller's control, or the control of Seller's suppliers or manufacturers, including without limitation failures or delays brought about by, caused by or in any manner arising from (i) labor conditions including strikes and shortages of labor, (ii) shortages of fuel, power, material or supplies, (iii) transportation delays, (iv) acts of God, fires, floods or weather problems, (v) damage to, or destruction in whole or in part of Goods, vehicles or manufacturing plants, (vi) accidents, or (vii) riots, government interference, embargos, regulations, war, insurrection or terrorist acts. The non-occurrence of the above contingencies with respect to Seller, its suppliers and manufacturers is a basic assumption of this agreement.

8. DELAY IN INSTRUCTIONS. Buyer agrees to furnish complete shipping instructions in such a manner as to reach the Seller at its main office ten (10) days before the date for any shipment specified herein. Buyer's failure to so furnish complete shipping instructions shall, without notice, automatically extend the shipping date from day to day until the Buyer furnishes complete shipping instructions, or until the Seller exercises its right to terminate the Agreement.

9. RISK OF LOSS. Unless Buyer and Seller specifically agree in writing to modify the terms of Paragraph 2. (d), above, all risk or loss shall pass to the Buyer when Goods are delivered by Seller to the carrier. In the event that Buyer and Seller agree in writing that the Goods are sold f.o.b. destination, Seller's responsibility for loss or damage terminates upon tender of delivery to Buyer by the carrier and the written acknowledgement and claims procedure provided for in Paragraph 4, above, shall be a precondition to any claim by Buyer for loss of damage in transit.

10. RETURNS. In no case are any Goods to be returned to Seller without first obtaining the written permission of Seller, which permission Seller may refuse to give at Seller's sole discretion. Only standard unused Goods as currently manufactured or inventoried by Seller which have been invoiced to Buyer within the previous ninety (90) days will be considered by Seller for return. Special items manufactured to order may not be returned under any circumstances. Goods which Seller accepts for return and credit will, in any event, be subject to a minimum handling and service charge of 25% plus all transportation charges. All returned Goods, if Seller accepts the return thereof, must in any case be securely packaged and shipped, freight prepaid, and the risk of loss shall remain with Buyer until the Seller actually receives the Goods.

11. DEFAULTS. In the event Buyer fails to comply with any of the terms of the Agreement or becomes bankrupt or insolvent or Buyer's financial condition becomes impaired or unsatisfactory to Seller, Seller may do any or all of the following: (a)Terminate the Agreement upon written notice thereof to Buyer without prejudice to Seller's rights to receive any amount then due under the Agreement; (b) Withhold all further deliveries under the Agreement; (c) require that Buyer pay for all future shipments in advance or provide other satisfactory security or guarantees to Seller that all existing and future invoices will be paid on or before their due dates; (d) Make partial shipments only to Buyer, which Buyer agrees to accept; (e) Recall any Goods then in transit and retake the same and repossess all Goods which may be stored with Seller in which case Buyer consents that all Goods so recalled, retaken or repossessed shall become the absolute property of Seller, provided that Buyer is given full credit therefor; (f) Upon written notice to Buyer revise the stated credit terms, if any, contained in this Agreement; (g) Without limitation, exercise any rights or remedies available to Seller under the Uniform Commercial Code as in force and effect on the date of the Agreement; or (h) Without limitation, exercise any other rights or remedies available to Seller under any applicable federal, state or local law.

12. ATTORNEY'S FEES. In the event of a default by Buyer of any of the terms or conditions of the Agreement, Buyer agrees to pay all costs of collection and enforcement incurred by Seller including, without limitation, Seller's reasonable attorney's fees and court costs.

13. RETENTION LIMITATION. Retention, if any is accepted by Pureflow Filtration Div., shall be limited to a maximum of ten percent (10%) of the contract price. All monies retained shall be paid, in full, upon successful "start-up" of the equipment supplied, or ninety (90) days after shipment of said goods, whichever date first occurs. The payment of monies retained under the terms of this paragraph is not conditioned upon any factors, issues, events or contingencies which are not specifically delineated in this quotation. The right of Pureflow Filtration Division to payment is NOT subject to any payment provisions enforced upon Buyer by the terms of any other contract with either Pureflow or a third party.

14. CONSEQUENTIAL / LIQUIDATED DAMAGES. The Buyer agrees that notwithstanding the form in which any legal or equitable action, proceeding or position may be brought or asserted by Buyer against Seller including without limitation claims based upon actual or alleged delays or breaches of warranty, that Seller's liability, if any, arising out of or in any way related to this Agreement, shall be limited to actual money damages in an amount not to exceed the total amount actually paid for the Goods by Buyer. Buyer further agrees that seller shall not, in any event, be liable for indirect, special, consequential or liquidated damages or penalties, whether based upon contract, warranty, tort, or negligence.

15. PROPRIETARY MATERIAL. All drawings, patterns, specifications, and information included in this proposal, and all information otherwise supplied by Pureflow Filtration Div. relating to the design, erection, operation, and maintenance of the goods, including filter media and all treatment processes, is the proprietary and / or confidential material or information of Pureflow Filtration Div. Purchaser shall not disclose such material or information to others or allow others to use such material or information without express written permission from an officer of Pureflow Filtration Div.

16. GOVERNING LAW / CONSENT TO JURISDICTION. (a) The terms and conditions set forth herein shall be construed under and in accordance with the laws of the State of California. The parties hereto consent to the jurisdiction and venue of any court of general jurisdiction in the Southeast District of Los Angeles County and the United States District Court for the Central District of California, with respect to any proceedings arising out of or in connection with the Agreement or any purchase hereunder, and further agree that mailing to either party by certified or registered mail shall constitute lawful and valid service of process. (b) No Waiver: No waiver by Seller of any default by Buyer shall be deemed a waiver of any subsequent default by Buyer. (c) Severability: Should any of the terms or conditions of the Agreement be declared invalid or unenforceable, it shall not affect the validity or enforceability of any of the remaining terms and conditions.

17. VALIDITY. The price quoted is firm for thirty (30) days, unless otherwise identified on the front of this quotation.

18. ERRORS. Pureflow Filtration Div. and Pureflow Ozone Div. of California Environmental Controls, Inc. reserves the right to correct or identify any scrivener's errors including, but not limited to typographical, clerical or dictation errors, in the quotation without any liability to Pureflow Filtration Div. or Pureflow Ozone Div., of California Environmental Controls, Inc.

19. TECHNICAL ADVICE. Upon Buyer's request, Seller may furnish technical advice with reference to the use of the material sold hereunder, to such extent as Seller has such information conveniently available; however, it is expressly agreed that there is no obligation to furnish any such advice, and that if any advice or assistance is furnished, which will be without charge, it shall be given and accepted at Buyer's risk, and Seller shall not be responsible or liable for the advice or assistance given or results thereof.

20. WARRANTIES: Except as provided below, Seller warrants that equipment or parts thereof delivered hereunder meet Sellers' standard specification for the equipment or parts, or such other specifications as have been expressly made as part of this Agreement. Equipment and parts sold, but not manufactured, by Seller are warranted to the extent of the manufacturer's original warranty. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED. SELLER MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE BUYER WILL MAKE NO WARRANTY OR MODIFY ANY EXISTING WARRANTY TO ANY CUSTOMER BEYOND ANY WARRANTY STATED BY SELLER'S SPECIFICATIONS. NO LIABILITY WILL RESULT TO EITHER PARTY FROM DELAY IN PERFORMANCE OR NON-PERFORMANCE CAUSED BY CIRCUMSTANCES BEYOND THE CONTROL OF THE PARTY AFFECTED. THE MEASURE OF DAMAGES RECOVERABLE BY BUYER SHALL NOT EXCEED THE PURCHASE PRICE PAID BY BUYER TO SELLER. THIS IS BUYER'S SOLE REMEDY AGAINST SELLER. SELLER SHALL NOT BE LIABLE FOR ANY INDIRECT OR PROSPECTIVE, CONSEQUENTIAL OR SPECIAL DAMAGES NOTWITHSTANDING THE FOREGOING. NO EQUIPMENT OR PARTS SHALL BE RETURNED WITHOUT INSTRUCTIONS FROM SELLER'S HOME OFFICE.

PF601.5

Pureflow© OZONE DIV.

Primozone®

SCOPE OF SUPPLY

FOR QUOTATION NO. Z2303009

DATE: MARCH 14, 2025

CLIENT

GEES MILL WATER TREATMENT PLANT

COUNTY OF ROCKDALE, GEORGIA

REPLACEMENT OZONE GENERATOR AND ANCILLARY EQUIPMENT

CONSULTING ENGINEER

ENGINEERING STRATEGIES, INC
3855 SHALLOWFORD RD, SUITE 525
MARIETTA, GEORGIA 30062

(770) 429-0001

REPRESENTATIVE

ECO-TECH, INC.
156 HICKORY SPRINGS INDUCTRIAL DRIVE
CANTON, GEORGIA, USA 30115

(404) 822-3313

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21 employees
3 Professional engineers
UL508A Panel shop

Representation Network

USA
Canada
Mexico

47 years

In Business

Treatment Technology

Coagulation Filtration
Ion Exchange
Ozone Generation
Advanced oxidation
Biological Treatment
System Automation

100%

commitment

TOP references for successfully delivered projects

Treatment Standards

NSF 60/61
W.H.O.
USEPA
SDHS

Industry Alliances

WEF
AWWA
CWEA
WateReuse Association
IOA

Trust
Innovation
Quality

Sustainability
Reliable service
Integrity

Municipal, General Industry, Oil & Gas, Aquaculture, Food & Beverage, Utilities, Textiles, Mining

1. INTRODUCTION

Primozone has named Pureflow their Strategic North American Partner for Engineered Systems. The partnership combines an unparalleled ozone generator technology that's revolutionizing the ozone industry with an industry proven water and wastewater process / system engineering team. The combination results in highly sophisticated, custom engineered systems based on ground water process / system engineering team. The combination results in highly sophisticated, custom engineered systems based on groundbreaking patented ozone generation technology and sound fundamental engineering. The technology is unrivaled, and the quality is unsurpassed.

1.1. PUREFLOW OZONE DIVISION

Pureflow Division of California Environmental Controls, Inc. was founded in 1973. Pureflow is an Original Equipment Manufacturer (OEM) that specializes in the design and manufacture of custom engineered processes and systems for the water and wastewater industry. Pureflow's reputation was established by providing quality, custom engineered, ground water pressure filtration system for the removal of heavy metals, sulfides, organics, etc. for drinking water purveyors across North America.

1.2. PRIMOZONE

Since its conception in 2000, Primozone Production AB has strived to provide industry revolutionizing technology. In 2003, Primozone was adopted by the Westfall-Larsen Technology group, a family-owned company founded in 1905 out of Bergen, Norway. Primozone is one (1) of several companies within the Westfal-Larsen family; all of which are dedicated to the research and development of highly-technical products.

The Westfall-Larsen group has invested several million dollars into the development of the Primozone's Ozone Generator.

2. THE TECHNOLOGY

The patented, cutting-edge technology behind the Primozone ozone generator is setting the standard for a new generation of ozone generators. The high ozone concentration, the small size and the low life-cycle cost are all features that differentiate the Primozone ozone generator from conventional ozone generators. Primozone is leading the development of innovative ozone technology for water treatment.

2.1. KEY FEATURES

High Production Capacity

Ozone production capacity from 0.54 lbs / day to 5,390 lbs / day.

Our custom engineered solutions can be designed with capacities to meet any ozone demand.

Highest Ozone Concentration on the Market

Ozone concentration of up to 20% by weight, the highest on the market. Seven (7) times less reduction in production capacity when operating at 16% by weight than the leading competitor.

Highest Gas Output Pressure

Ozone gas outlet pressures of up to 43.5 psig increase the potential to feed ozone into solution without the need of booster pumps and venturi injectors.

Lowest Oxygen Consumption on the Market

High ozone concentration reduces the oxygen consumption by 50%.

Maintenance-Free Reactors

No time-consuming cleaning of the reactor is necessary. The only maintenance required is an annual inspection.

Sophisticated Controls

Automatic, continuous gas flow or ozone concentration modulation.

Modularity

The modular design ensures a built-in redundancy and there is no need to oversize.

Reduced Footprint

Saves space and enables easy retrofitting.

Energy Conservation

Lower oxygen consumption means lower oxygen production; resulting in smaller air compressors. Higher ozone concentrations yield lower gas volumes; reducing booster pump power requirements for injection. Lower gas volumes at higher concentrations improve dissolution of ozone in water; producing higher mass transfer efficiencies. All things equate to a substantial energy savings.

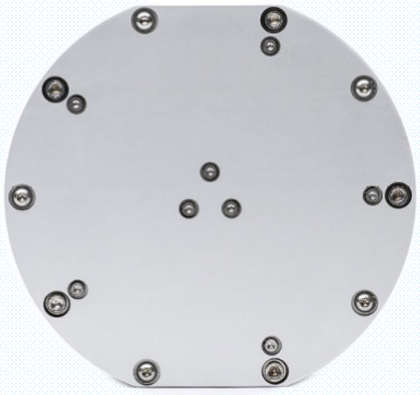
Safe, Quiet and EMC-Approved

EMC-approval certifies that the ozone generator has no electromagnetic fields that interferes with other products or endangers the safety of the operator. With a noise level of less than 55 dB, this ozone generator can be placed anywhere.

2.2. THE OZONE REACTOR

Primozone's patented ozone generation reactor takes traditional cold plasma ozone generation technology to the next level. The double-sided, flat electrode design is the most compact on the market compared to reactors of comparable capacity and concentration.

The compact platform reduces the distance the oxygen travels compared to glass tube style reactors, and allows for significantly higher internal pressures, creating a more efficient environment for oxygen gas to ozone gas conversion. All things key to the Primozone generator's ability to produce ozone gas at concentrations and output pressures remarkably higher than the competition.



2.3. THE POWER SUPPLY

Only Primozone offers modularity like this. Pairing a completely independent, dedicated power supply with every ozone generation cell produces unrivaled flexibility and built-in redundancy. Operating at 40,000 Hz, double the frequency of the competition, the quiet power supply contributed to the low overall sound level of only 55 dBA at 3 feet without the addition of a sound mitigating device.

3. DESIGN CONSIDERATION

System Flow Rate	TBD
Side Stream Flow Rate	N / A
Ozone Concentration	10 - 20% by weight
Ozone Dosage	TBD
Ambient Temperature (Max)	TBD
Ambient Temperature (Min)	TBD
Water Temperature (Max)	TBD
Water Temperature (Min)	TBD
Injection Transfer Efficiency	TBD

4. PROPOSED SYSTEM SUMMARY

- One (1) Oxygen Filtration & Pressure Regulation System
- One (1) Ozone Generation Systems
- One (1) Ozone System Master Control Panel

5. TECHNICAL SPECIFICATIONS OF MAJOR EQUIPMENT

OZONE GENERATOR	
Manufacturer	Primozone
Model No.	GM-48
Quantity of Units	One (1)
Ozone Concentration	10% by weight 14% by weight
Capacity, Unit (unit)	150 lb / day @ 10% by weight 122 lb / day @ 14% by weight
Oxygen Consumption (unit)	740 cfh @ 10% by weight 440 cfh @ 14% by weight
Electrical	480 VAC / 3 pH / 60 Hz
Power Consumption (unit)	28.8 kW max power

6. SCOPE OF SUPPLY

6.1. OXYGEN FILTRATION & PRESSURE REGULATION MANIFOLD (SEE NOTE 3)

ITEM	QTY	DESCRIPTION
6.1.1.	1	Particulate Filter, flanged, 316 SS, w/ element
6.1.2.	1	Pressure regulator, flanged, 316 SS
6.1.3.	1	Pressure safety valve
6.1.4.	2	Manual process isolation ball valves, flanged, 316 SS
6.1.5.	LOT	Instrumentation isolation ball valves, pressure gauges, etc.
6.1.6.	LOT	Interconnecting flanged welded 316 SS pipe spools, passivated
6.1.7.	LOT	Shop assembly of the above items including gaskets, hardware, etc. cleaned for oxygen service

6.2. OZONE GENERATION SYSTEM (SEE NOTE 3)

ITEM	QTY	DESCRIPTION
6.2.1.	1	Primozone ozone generator, 120 ppd @ 14% ozone by weight, 150 ppd @ 10% ozone by weight
6.2.2.	1	Transformer, Primary: 480VAC / 3pH / 60Hz, Secondary: 400VAC / 3pH / 60Hz. Not mounted on skid assembly.
6.2.3.	1	Primozone backflow protector
6.2.4.	3	Manual process isolation ball valves
6.2.5.	3	Electrically actuated process isolation ball valves
6.2.6.	LOT	Check valves, pressure safety valve, utility ball valves, etc.
6.2.7.	LOT	Interconnecting flanged welded 316 SS pipe spools, passivated
6.2.8.	LOT	Shop assembly of the above items including gaskets, hardware, etc. cleaned for oxygen service
6.2.9.	1	Primozone LOX Booster w/ oil-less air compressor, 120VAC/1pH/60Hz. Oil-less air compressor not mounted on skid assembly.

6.3. PLC BASED CONTROL PANEL (SEE NOTE 1 AND 3)

ITEM	QTY	DESCRIPTION
6.3.1.	1	Master Ozone Control Panel, including HMI, PLC, ethernet Communication, uninterruptable power supply (UPS), UL508A listed. MOCP included in this proposal shall be dedicated to the operation of equipment on this skid assembly only. Skid mounted.

6.4. INSTRUMENTATION

ITEM	QTY	DESCRIPTION
6.4.1.	1	Ambient ozone monitor, ATI, skid mounted
6.4.2.	1	Ambient oxygen monitor, ATI, skid mounted
6.4.3.	1	Dewpoint monitor, Kahn

6.5. SPARE PARTS

ITEM	QTY	DESCRIPTION
6.5.1.	LOT	Available upon request

6.6. ENGINEERING EQUIPMENT SUBMITTALS

ITEM	QTY	DESCRIPTION
6.6.1.	1	Digital Copy, indexed, including, calculations, drawings, datasheets, etc.

6.7. OPERATION & MAINTENANCE MANUALS

ITEM	QTY	DESCRIPTION
6.7.1.	1	Digital Copy, indexed, including, calculations, drawings, datasheets, etc.

7. DELIVERY

7.1. ENGINEERING / EQUIPMENT SUBMITTALS

Ten (10) to twelve (12) weeks from receipt of purchase order. Based on lead times as of March 14, 2025.

7.2. EQUIPMENT DELIVERY

Eighteen (18) to twenty (20) weeks from approval of engineering equipment submittals and / or notice to proceed with procurement / fabrication. Based on leads as of March 14, 2025.

8. ON-SITE SERVICES

8.1. PRE-STARTUP ASSISTANCE

ITEM	QTY	DESCRIPTION
8.1.1.	LOT	One (1) trip, three (3) days on-site

8.2. START-UP / COMMISSIONING

ITEM	QTY	DESCRIPTION
8.2.1.	LOT	Two (2) trips, ten (10) days on-site total

8.3. OPERATOR TRAINING

ITEM	QTY	DESCRIPTION
8.3.1.	LOT	One (1) trip, two (2) days on-site, trip shall coincide with system start-up / commissioning

9. STANDARD WARRANTY

Eighteen (18) months from shipment or twelve (12) months from customer buy-off, whichever occurs first

10. EXCLUSIONS

- Storage
- Off-loading
- Installation
- Taxes
- Permits, Fees, Tariffs
- Interconnecting piping, tubing, pipe supports, anchor bolts, etc.
- Field Wiring
- Closed loop chilled water system, see note 2 below
- Mass transfer system
- Lox system
- Ozone destruct units
- Analytical equipment other than those items offered at an additional cost.
- SCADA integration

11. COMMERCIAL TERMS AND CONDITIONS

This scope of supply includes only equipment specifically mentioned herein and does not include, or infer inclusion of, any additional equipment, piping, valves, wiring, installation or services, regardless of its relationship to the supplied equipment.

12. NOTES

1. The PLC based, Master Ozone Control Panel (MOCP) included in this budget proposal will interface with the equipment defined herein only. Connection between the new MOCP and the existing water treatment plant SCADA system shall be via CAT 6 cable provided by others.
2. Regarding the existing cooling water system, all ferrous components in direct contact with the cooling water must be replacement with components fabricated of non-ferrous material.
3. EQUIPMENT INCLUDED IN THIS BUDGET PROPOSAL WILL BE MOUNTED, PLUMBED, AND WIRED ON AN EPOXY COATED, CARBON STEEL, SKID ASSEMBLY WITH THE EXCEPTION OF THE 480V to 400V TRANSFORMER (6.2.2.) AND THE OIL-LESS AIR COMPRESSOR REQUIRED FOR THE LOX BOOSTER SYSTEM (6.2.9.).