

COLLIER COUNTY, FLORIDA

BIDDING REQUIREMENTS
AND
CONTRACT DOCUMENTS

for the construction of the

NORTH COUNTY REGIONAL WATER TREATMENT PLANT DEGASIFIER UPGRADES

JACOBS ENGINEERING GROUP

Naples, FL 34108

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Project No. 705767

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

Pages

DIVISION 1—GENERAL REQUIREMENTS

01 11 00	Summary of Work.....	1-	3
01 29 00	Payment Procedures.....	1-	3
01 31 19	Project Meetings	1-	3
01 32 00	Construction Progress Documentation	1-	5
01 33 00	Submittal Procedures	1-	9
01 33 00-SUP	Transmittal of Contractor’s Submittal	1-	1
01 61 00	Common Product Requirements	1-	8
01 61 00-SUP	Manufacturer’s Certificate of Compliance	1-	1
01 77 00	Closeout Procedures.....	1-	4
01 78 23	Operations and Maintenance Data	1-	7

DIVISIONS 2 THROUGH 25

01 77 00	Welding.....	1-	4
01 77 00-SUP	Welding and Nondestructive Testing Table	1-	1
09 90 00	Painting and Coatings	1-	6
09 90 00-SUP1	Paint System Data Sheet	1-	1
09 90 00-SUP2	Paint Product Data Sheet	1-	1

DIVISION 26—ELECTRICAL

26 05 01	Electrical	1-	16
26 24 16	Panelboards.....	1-	7

DIVISION 30 THROUGH 40—PROCESS INTEGRATION

33 13 00	Disinfection of Water Facilities	1-	4
40 27 00.00	Process Piping—General	1-	11
40 27 00.08	Stainless Steel Pipe and Fittings-General Service	1-	3
40 27 00.10	Polyvinyl Chloride (PVC) Pipe and Fittings	1-	2
40 27 02	Process Piping Specialties	1-	12
40 27 02	Process Valves and Operators	1-	6
40 80 01	Process Piping Leakage Testing	1-	5
40 90 01	Instrumentation and Control for Process Systems	1-	22

DRAWINGS (BOUND SEPARATELY)

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. The completed Work will provide the County with Degasifier system improvements at the existing North County Regional Water Treatment Plant (NCRWTP). The work is described below and as shown and detailed on the Drawings.
- B. The Project includes modifications, repairs, replacement of existing facilities and installation of new equipment in accordance with the following.
- C. Scope:
 - 1. Provide and install PVC piping to connect existing degasifier cleaning lines with the existing degasifier cleaning pump as shown on the drawings with associated pipe supports, valves, and fittings.
 - 2. Provide and install PVC drain piping as shown on the drawings with associated pipe supports, camlock fitting and isolation valve.
 - 3. Provide and install PVC cleaning piping mounted to the side of the degasifiers as shown on the drawings with associated pipe supports, and isolation valves.
 - 4. Provide and install four new modulating actuators on the existing degasifier inlet butterfly valves.
 - 5. Provide and install four new magnetic flowmeters on the existing degasifier feed lines. Cut existing 316 SST piping and weld on new 316 SST 150# flanges connection of the new flow meters.
 - 6. Provide a new valve control panel for operating four new modulating actuators and for monitoring of the flow control valve positions and degasifier inlet flow readings
 - 7. Integrate the new valve control panel with the facility Ethernet network for remote monitoring of the valve positions and flow readings, with potential to allow remote control at a later time if needed.
 - 8. Supply and install new power center, control panel, all associated raceway, conductors, grounding, fasteners, hardware, circuit breakers, and materials to provide a complete power, control, and instrumentation interconnections for a functioning complete system for the operation of valve actuators, signal interfacing, flow transmitters, local and remote-control interconnections.
 - 9. Details are contained on the contract drawings and in further sections of these specifications.

PART 2 PRODUCTS

2.01 PRODUCTS

- A. Shall be as specified herein.

PART 3 EXECUTION

- A. All work shall be coordinated with County. Only one degasifier can be removed from service at a time. Work shall only commence on the next degasifier when Work on the previous degasifier has been completed and accepted by the Owner and Engineer, including cleaning, pipe pressure testing and disinfection.
- B. Contractor to field verify all dimensions prior to shop drawing submittal.
- C. County shall provide a staging area, Contractor to coordinate with the owner for details.
- D. Electrical power and water facilities will be available on site and the cost will be borne by Owner. Temporary facilities to obtain and transport these services to the point of application shall be borne by Contractor.
- E. The Contractor shall provide portable toilet facilities for the field staff.
- F. The Engineer will schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with Contractor's input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes. Contractor shall produce a detailed schedule at the pre-construction meeting and shall provide updates at each progress meeting.
- G. Contractor shall provide electronic submittals of materials and equipment used for the work, for approval, to Engineer. If not approved by Owner, Contractor shall provide re-submittals. Prior to transport of materials and equipment to site and installation in the Work, the submittals shall be approved by Owner.
- H. As part of the close-out, contractor shall provide record drawings of the finished Work.
- I. In case of damage to existing facilities, Owner shall be notified immediately, and the Contractor shall be responsible for the repairs.
- J. Contractor shall obtain all required permits and regulatory approvals for the execution of the Work.

- K. The Contractor's staff shall have obtained Owner's security clearance and shall require wearing their ID badges at work on site at all times.
- L. Each day, the Contractor's field staff shall sign-in and sign-out at the visitor's desk in the Operations Building.
- M. The Contractor's field staff shall participate in a chemical safety walk through orientation with the Owner's Operational Staff from NCRWTP
- N. Allowable work times are 7:00 am to 5:00 pm Monday through Friday. The NCRWTP Owner's Project Manager shall pre-approve Saturday work with 24-hour notice of the request for approval.
- O. The piping assemblies shall be disinfected after they have been cleaned, completed and accepted in terms of internal coating, hydrostatic pressure/leakage tested as a gravity pipe using potable water. Disinfection shall be performed with spraying sodium hypochlorite in accordance with method described in AWWA C652. The Contractor shall be responsible for disposal of test waters and shall neutralize the sodium hypochlorite solution.

END OF SECTION

**SECTION 01 29 00
PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Informational Submittals:
 - 1. Schedule of Values: Submit on Owner's form.
 - 2. Schedule of Estimated Progress Payments:
 - a. Submit with initially acceptable Schedule of Values.
 - b. Submit adjustments thereto with Application for Payment.
 - 3. Application for Payment.
 - 4. Final Application for Payment.

1.02 SCHEDULE OF VALUES

- A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.
- B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.
- C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.
- D. Lump Sum Work:
 - 1. Reflect specified contingency allowances and alternates, as applicable.
 - 2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
- E. An unbalanced or front-end loaded schedule will not be acceptable.
- F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

1.03 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

- A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.
- B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.04 APPLICATION FOR PAYMENT

- A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.
- B. Use detailed Application for Payment Form provided by Owner.
- C. Provide separate form for each schedule as applicable.
- D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.
- E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.
- F. Preparation:
 - 1. Round values to nearest dollar.
 - 2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

1.05 PAYMENT

- A. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.

1.06 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

- A. Payment will not be made for 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. Defective Work not accepted by Owner.
 - 6. Material remaining on hand after completion of Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 31 19
PROJECT MEETINGS**

PART 1 GENERAL

1.01 GENERAL

- A. The Engineer will schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within two days after each meeting to participants and parties affected by meeting decisions.

1.02 PRECONSTRUCTION CONFERENCE

- A. Contractor shall be prepared to discuss the following subjects, as a minimum:

1. Required schedules.
2. Status of Bonds and insurance.
3. Sequencing of critical path work items.
4. Progress payment procedures.
5. Project changes and clarification procedures.
6. Use of Site, access, office and storage areas, security and temporary facilities.
7. Major product delivery and priorities.
8. Contractor's safety plan and representative.

- B. Attendees will include:

1. Owner's representatives.
2. Contractor's office representative.
3. Contractor's resident superintendent.
4. Contractor's quality control representative.
5. Subcontractors' representatives whom Contractor may desire or Engineer may request to attend.
6. Engineer's representatives.
7. Others as appropriate.

1.03 PRELIMINARY SCHEDULES REVIEW MEETING

- A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.

1.04 PROGRESS MEETINGS

- A. Owner will schedule regular progress meetings at Site, conducted weekly to review the Work progress, Progress Schedule, Schedule of Submittals, Application for Payment, contract modifications, and other matters needing discussion and resolution.
- B. Attendees will include:
 - 1. Owner's representative(s), as appropriate.
 - 2. Contractor, Subcontractors, and Suppliers, as appropriate.
 - 3. Engineer's representative(s), when requested.
 - 4. Others as appropriate.

1.05 PREINSTALLATION MEETINGS

- A. When required in individual Specification sections, convene at Site prior to commencing the Work of that section.
- B. Require attendance of entities directly affecting, or affected by, the Work of that section.
- C. Notify Owner 4 days in advance of meeting date.
- D. Provide suggested agenda to Owner to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.06 FACILITY STARTUP MEETINGS

- A. Schedule and attend a minimum of two facility startup meetings. The first of such meetings shall be held prior to submitting Facility Startup Plan, as specified in Section 01 91 14, Equipment Testing and Facility Startup, and shall include preliminary discussions regarding such plan.
- B. Agenda items shall include, but not be limited to, content of Facility Startup Plan, coordination needed between various parties in attendance, and potential problems associated with startup.
- C. Attendees will include:
 - 1. Contractor.
 - 2. Contractor's designated quality control representative.
 - 3. Subcontractors and equipment manufacturer's representatives whom Contractor deems to be directly involved in facility startup.

4. Engineer's representatives.
5. Owner's operations personnel.
6. Others as required by Contract Documents or as deemed necessary by Contractor.

1.07 OTHER MEETINGS

- A. In accordance with Contract Documents and as may be required by Owner and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
 - a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
 - b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
3. Submit with Each Progress Schedule Submission:
 - a. Contractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
 - b. Progress Schedule: One legible copy.
 - c. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 DETAILED PROGRESS SCHEDULE

- A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.
- B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.
- C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.
- D. Format: In accordance with Article Progress Schedule—Bar Chart.
- E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.03 PROGRESS SCHEDULE—BAR CHART

- A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.
- B. Format:
 - 1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
 - 2. Title Block: Show name of project and Owner, date submitted, revision or update number, and name of scheduler.
 - 3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.
 - 4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
 - 5. Legend: Describe standard and special symbols used.
- C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
 - 1. Obtaining permits, submittals for early product procurement, and long lead time items.
 - 2. Mobilization and other preliminary activities.
 - 3. Initial Site work.
 - 4. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s).
 - 5. Subcontract Work.
 - 6. Major equipment design, fabrication, factory testing, and delivery dates.
 - 7. Sitework.
 - 8. Concrete Work.
 - 9. Equipment Work.
 - 10. Mechanical Work.
 - 11. Electrical Work.
 - 12. Equipment and system startup and test activities.
 - 13. Project closeout and cleanup.
 - 14. Demobilization.

1.04 PROGRESS OF THE WORK

- A. Updated Progress Schedule shall reflect:
 - 1. Progress of Work to within 5 working days prior to submission.
 - 2. Approved changes in Work scope and activities modified since submission.
 - 3. Delays in Submittals or resubmittals, deliveries, or Work.
 - 4. Adjusted or modified sequences of Work.

5. Other identifiable changes.
 6. Revised projections of progress and completion.
 7. Report of changed logic.
- B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.
- C. If Contractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.
- D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:
1. Complete a Milestone activity by its completion date.
 2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.05 NARRATIVE PROGRESS REPORT

- A. Format:
1. Organize same as Progress Schedule.
 2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.
- B. Contents:
1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
 2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
 3. Contractor's plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
 4. Identification of new activities and sequences as a result of executed Contract changes.
 5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.

6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.06 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
 - a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
 - b. Specified Work sequences and constraints are shown as specified.
 - c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
 - d. Access restrictions are accurately reflected.
 - e. Startup and testing times are as specified.
 - f. Submittal review times are as specified.
 - g. Startup testing duration is as specified and timing is acceptable.
2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgement, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

- C. Unacceptable Detailed Progress Schedule:
 - 1. Make requested corrections; resubmit within 10 days.
 - 2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

- D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.07 ADJUSTMENT OF CONTRACT TIMES

- A. Reference General Conditions.

- B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

- C. Claims Based on Contract Times:
 - 1. Where Engineer has not yet rendered formal decision on Contractor's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, Contractor shall reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.
 - 2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
 - 3. Contractor shall revise Progress Schedule prepared thereafter in accordance with Engineer's formal decision.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

- A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.
- B. Informational Submittal: Information submitted by Contractor that requires Engineer's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

- A. Direct submittals to Engineer at the following, unless specified otherwise.
 - 1. Available at preconstruction conference.
- B. Submittals may be made in electronic format.
 - 1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
 - 2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the Document.
 - 3. PDF files shall be set to open "Bookmarks and Page" view.
 - 4. Add general information to each PDF file, including title, subject, author, and keywords.
 - 5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
 - 6. Submit new electronic files for each resubmittal.
 - 7. Include a copy of the Transmittal of Contractor's Submittal form, located at end of section, with each electronic file.
 - 8. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
 - 9. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

C. Transmittal of Submittal:

1. Contractor shall:
 - a. Review each submittal and check for compliance with Contract Documents.
 - b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
 - 1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
 - 2) Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form attached at end of this section.
3. Identify each submittal with the following:
 - a. Numbering and Tracking System:
 - 1) Sequentially number each submittal.
 - 2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
 - b. Specification section and paragraph to which submittal applies.
 - c. Project title and Engineer's project number.
 - d. Date of transmittal.
 - e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.

D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

E. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual Specification sections.

F. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
 - a. Contractor's review stamp; completed and signed.
 - b. Transmittal of Contractor's Submittal; completed and signed.
 - c. Insufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return submittal to Contractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:

1. Copies: Six.
2. Identify and Indicate:
 - a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
 - b. Equipment and Component Title: Identical to title shown on Drawings.
 - c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.

- d. Project-specific information drawn accurately to scale.
- 3. Manufacturer's standard schematic drawings and diagrams as follows:
 - a. Modify to delete information that is not applicable to the Work.
 - b. Supplement standard information to provide information specifically applicable to the Work.
- 4. Product Data: Provide as specified in individual Specifications.
- 5. Deferred Submittal: See Drawings for list of deferred submittals.
 - a. Contractor-design drawings and product data related to permanent construction.
 - 1) Written and graphic information.
 - 2) Drawings.
 - 3) Cut sheets.
 - 4) Data sheets.
 - 5) Action item submittals requested in individual Specification section.
- 6. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.

C. Samples:

- 1. Copies: Two, unless otherwise specified in individual Specifications.
- 2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
 - a. Manufacturer name.
 - b. Model number.
 - c. Material.
 - d. Sample source.
- 3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
- 4. Full-size Samples:
 - a. Size as indicated in individual Specification section.
 - b. Prepared from same materials to be used for the Work.
 - c. Cured and finished in manner specified.
 - d. Physically identical with product proposed for use.

D. Action Submittal Dispositions: Engineer will review, comment, stamp, and distribute as noted:

- 1. Approved:
 - a. Contractor may incorporate product(s) or implement Work covered by submittal.
 - b. Distribution:
 - 1) One copy furnished Owner.
 - 2) One copy furnished Resident Project Representative.

- 3) One copy retained in Engineer's file.
 - 4) Remaining copies returned to Contractor appropriately annotated.
2. Approved as Noted:
 - a. Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
 - b. Distribution:
 - 1) One copy furnished Owner.
 - 2) One copy furnished Resident Project Representative.
 - 3) One copy retained in Engineer's file.
 - 4) Remaining copies returned to Contractor appropriately annotated.
 3. Partial Approval, Resubmit as Noted:
 - a. Make corrections or obtain missing portions, and resubmit.
 - b. Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
 - c. Distribution:
 - 1) One copy furnished Owner.
 - 2) One copy furnished Resident Project Representative.
 - 3) One copy retained in Engineer's file.
 - 4) Remaining copies returned to Contractor appropriately annotated.
 4. Revise and Resubmit:
 - a. Contractor may not incorporate product(s) or implement Work covered by submittal.
 - b. Distribution:
 - 1) One copy furnished Resident Project Representative.
 - 2) One copy retained in Engineer's file.
 - 3) Remaining copies returned to Contractor appropriately annotated.

1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Copies: Submit three copies, unless otherwise indicated in individual Specification section.
2. Refer to individual Specification sections for specific submittal requirements.

3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward copy to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one copy and return remaining copy with review comments to Contractor, and require that submittal be corrected and resubmitted.

B. Certificates:

1. General:
 - a. Provide notarized statement that includes signature of entity responsible for preparing certification.
 - b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual Specification sections.
3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual Specification section.
4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.
6. Manufacturer's Certificate of Compliance: In accordance with Section 01 61 00, Common Product Requirements.
7. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 43 33, Manufacturers' Field Services.

C. Construction Photographs: In accordance with Division 1, General Requirements, and as may otherwise be required in Contract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

E. Contractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual Specification section.

- F. Deferred Submittals: See Drawings for list of deferred submittals.
1. Contractor-design data related to permanent construction:
 - a. List of assumptions.
 - b. List of performance and design criteria.
 - c. Summary of loads or load diagram, if applicable.
 - d. Calculations.
 - e. List of applicable codes and regulations.
 - f. Name and version of design software.
 - g. Factory test results.
 - h. Informational submittals requested in individual Specification section.
 2. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit calculations and test results of Contractor-designed components for review by Engineer. Documentation of review and indication of compliance with general design intent and project criteria provided on Engineer's comment form as meets conditions of the Contract, along with completed submittal, and approved by permitting agency prior to installation.
- G. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual Specification section.
- H. Operation and Maintenance Data: As required in Division 1, General Requirements.
- I. Payment:
1. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.
 2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.
 3. Schedule of Estimated Progress Payments: In accordance with Section 01 29 00, Payment Procedures.
- J. Schedules:
1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
 - a. Show for each, at a minimum, the following:
 - 1) Specification section number.
 - 2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.

- 3) Estimated date of submission to Engineer, including reviewing and processing time.
 - b. On a monthly basis, submit updated Schedule of Submittals to Engineer if changes have occurred or resubmittals are required.
 2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.
- K. Special Guarantee: Supplier's written guarantee as required in individual Specification sections.
- L. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.
- M. Submittals Required by Laws, Regulations, and Governing Agencies:
1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
 2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.
- N. Test, Evaluation, and Inspection Reports:
1. General: Shall contain signature of person responsible for test or report.
 2. Factory:
 - a. Identification of product and specification section, type of inspection or test with referenced standard or code.
 - b. Date of test, Project title and number, and name and signature of authorized person.
 - c. Test results.
 - d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
 - e. Provide interpretation of test results, when requested by Engineer.
 - f. Other items as identified in individual Specification sections.
 3. Field:
 - a. As a minimum, include the following:
 - 1) Project title and number.
 - 2) Date and time.
 - 3) Record of temperature and weather conditions.
 - 4) Identification of product and Specification section.
 - 5) Type and location of test, Sample, or inspection, including referenced standard or code.

- 6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
- 7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
- 8) Provide interpretation of test results, when requested by Engineer.
- 9) Other items as identified in individual Specification sections.

O. Testing and Startup Data: In accordance with Section 01 91 14, Equipment Testing and Facility Startup.

P. Training Data: In accordance with Section 01 43 33, Manufacturers' Field Services.

1.05 SUPPLEMENTS

A. The supplement listed below, following "End of Section", is part of this specification.

1. Form: Transmittal of Contractor's Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL
(ATTACH TO EACH SUBMITTAL)

DATE: _____

<p>TO: _____ _____ _____ _____</p> <p>FROM: _____ Contractor _____ _____</p>	<p>Submittal No.: _____</p> <p><input type="checkbox"/> New Submittal <input type="checkbox"/> Resubmittal</p> <p>Project: _____</p> <p>Project No.: _____</p> <p>Specification Section No.: _____ (Cover only one section with each transmittal)</p> <p>Schedule Date of Submittal: _____</p>
<p>SUBMITTAL TYPE: <input type="checkbox"/> Shop Drawing <input type="checkbox"/> Sample <input type="checkbox"/> Informational</p> <p> <input type="checkbox"/> Deferred</p>	

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____
Contractor (Authorized Signature)

**SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

1. New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and may also include existing materials or components required for reuse.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 50 feet above sea level.
- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 60 degrees F to 104 degrees F.

1.03 PREPARATION FOR SHIPMENT

- A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

- C. Extra Materials, Special Tools, Test Equipment, and Expendables:
 - 1. Furnish as required by individual Specifications.
 - 2. Schedule:
 - a. Ensure that shipment and delivery occurs concurrent with shipment of associated equipment.
 - b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
 - 3. Packaging and Shipment:
 - a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
 - b. Prominently displayed on each package, the following:
 - 1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
 - 2) Applicable equipment description.
 - 3) Quantity of parts in package.
 - 4) Equipment manufacturer.
 - 4. Notify Owner upon arrival for transfer of materials.
 - 5. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.
- D. Request a minimum 7-day advance notice of shipment from manufacturer.
- E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.04 DELIVERY AND INSPECTION

- A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.
- B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.
- C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

- D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.05 HANDLING, STORAGE, AND PROTECTION

- A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, Temporary Facilities and Controls. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.
- D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.
- E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.
- G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.
- H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual Specifications.
- B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.
- C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.
- D. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- E. Provide interchangeable components of the same manufacturer, for similar components, unless otherwise specified.
- F. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.
- G. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.
- H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.
- I. Authority Having Jurisdiction (AHJ):
 - 1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.

2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.
- J. Equipment Finish:
1. Provide manufacturer's standard finish and color, except where specific color is indicated.
 2. If manufacturer has no standard color, provide equipment with gray finish as approved by Owner.
- K. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.
- L. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.
- M. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 FABRICATION AND MANUFACTURE

- A. General:
1. Manufacture parts to U.S.A. standard sizes and gauges.
 2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
 3. Design structural members for anticipated shock and vibratory loads.
 4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
 5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

- A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.
- B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).
- C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

- A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.
- B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

- C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.
- D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 INSTALLATION

- A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. No shimming between machined surfaces is allowed.
- C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Repaint painted surfaces that are damaged prior to equipment acceptance.
- E. Do not cut or notch any structural member or building surface without specific approval of Engineer.
- F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review at all times.
- G. For material and equipment specifically indicated or specified to be reused in the Work:
 - 1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
 - 2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.04 FIELD FINISHING

- A. In accordance with Section 09 90 00, Painting and Coating, and individual Specification sections.

3.05 ADJUSTMENT AND CLEANING

- A. Perform required adjustments, tests, operation checks, and other startup activities.

3.06 LUBRICANTS

- A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

3.07 SUPPLEMENTS

- A. The supplement listed below, following “End of Section”, is part of this specification.
 - 1. Form: Manufacturer’s Certificate of Compliance.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: _____ PRODUCT, MATERIAL, OR SERVICE
PROJECT NAME: _____ SUBMITTED: _____
PROJECT NO: _____

Comments: _____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20__

Manufacturer: _____

Manufacturer's Authorized Representative (*print*): _____

(Authorized Signature)

**SECTION 01 77 00
CLOSEOUT PROCEDURES**

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
 - a. Record Documents: As required in General Conditions.
 - b. Approved Shop Drawings and Samples: As required in the General Conditions.
 - c. Special bonds, Special Guarantees, and Service Agreements.
 - d. Consent of Surety to Final Payment: As required in General Conditions.
 - e. Releases or Waivers of Liens and Claims: As required in General Conditions.
 - f. Releases from Agreements.
 - g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
 - h. Extra Materials: As required by individual Specification sections.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
 - a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
 - b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.

4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on 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 Drawings.
 - 2) Red when showing information added to Drawings.
 - 3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by "cloud" drawn around area or areas affected.
4. 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, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
- a. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like.
 - b. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).
 - c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

- A. At completion of the Work or of a part thereof and immediately prior to Contractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor's notice of completion, clean entire Site or parts thereof, as applicable.
- 1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner.
 - 2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
 - 3. Repair, patch, and touchup marred surfaces to specified finish and match adjacent surfaces.
 - 4. Clean all windows.
 - 5. Clean and wax wood, vinyl, or painted floors.
 - 6. Broom clean exterior paved driveways and parking areas.
 - 7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
 - 8. Rake clean all other surfaces.
 - 9. Remove snow and ice from access to buildings.

10. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
 11. Leave water courses, gutters, and ditches open and clean.
- B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.

1.02 DEFINITIONS

- A. Preliminary Data: Initial and subsequent submissions for Engineer's review.
- B. Final Data: Engineer-accepted data, submitted as specified herein.
- C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03 SEQUENCING AND SCHEDULING

- A. Equipment and System Data:
 - 1. Preliminary Data:
 - a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
 - b. Submit prior to shipment date per Section 01 91 14, Installation, Testing, and Training Services.
 - 2. Final Data: Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.
- B. Materials and Finishes Data:
 - 1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
 - 2. Final Data: Submit within 10 days after final inspection.

1.04 DATA FORMAT

- A. Prepare preliminary data in the form of an instructional manual. Prepare final data in data compilation format.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title "Operation and Maintenance Data" and list:
 - a. Project title.
 - b. Designate applicable system, equipment, material, or finish.
 - c. Identity of separate structure as applicable.
 - d. Identity of general subject matter covered in manual.
4. Title Page:
 - a. Contractor name, address, and telephone number.
 - b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
 - 1) Identify area of responsibility of each.
 - 2) Provide name and telephone number of local source of supply for parts and replacement.
5. Table of Contents:
 - a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
 - b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
6. Paper: 20-pound minimum, white for typed pages.
7. Text: Manufacturer's printed data, or neatly typewritten.
8. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
 - a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
 - b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
 - c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
 - a. Submit three copies for Engineer's review.
 - b. If data meets conditions of the Contract:
 - 1) Two copies will be returned to Contractor.
 - 2) One copy will be forwarded to Resident Project Representative.
 - c. If data does not meet conditions of the Contract:
 - 1) All copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
 - 2) Engineer's comments will be retained in Engineer's file.
 - 3) Resubmit two copies revised in accordance with Engineer's comments.
 - d. If using electronic submittal process, then only one copy is submitted.
3. Final Data: Submit four hard copies in format specified herein and in electronic PD version on a CD.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:

1. Product Data:
 - a. Include only those sheets that are pertinent to specific product.
 - b. Clearly annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - c. Function, normal operating characteristics, and limiting conditions.
 - d. Performance curves, engineering data, nameplate data, and tests.
 - e. Complete nomenclature and commercial number of replaceable parts.
 - f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
 - g. Spare parts ordering instructions.
 - h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).

2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
 - a. Format:
 - 1) Provide reinforced, punched, binder tab; bind in with text.
 - 2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
 - 3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
 - 4) Identify Specification section and product on Drawings and envelopes.
 - b. Relations of component parts of equipment and systems.
 - c. Control and flow diagrams.
 - d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
 - a. Format:
 - 1) Organize in consistent format under separate heading for each different procedure.
 - 2) Provide logical sequence of instructions for each procedure.
 - 3) Provide information sheet for Owner's personnel, including:
 - a) Proper procedures in event of failure.
 - b) Instances that might affect validity of guarantee or Bond.
 - b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
 - c. Operating Procedures:
 - 1) Start-up, break-in, routine, and normal operating instructions.
 - 2) Test procedures and results of factory tests where required.
 - 3) Regulation, control, stopping, and emergency instructions.
 - 4) Description of operation sequence by control manufacturer.
 - 5) Shutdown instructions for both short and extended duration.
 - 6) Summer and winter operating instructions, as applicable.
 - 7) Safety precautions.
 - 8) Special operating instructions.
 - d. Maintenance and Overhaul Procedures:
 - 1) Routine maintenance.
 - 2) Guide to troubleshooting.
 - 3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Format: Follow format provided in supplement, Document Section Requirements.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, nameplate data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards.
3. Electrical service.
4. Control requirements and interfaces.
5. Communication requirements and interfaces.
6. List of electrical relay settings, and control and alarm contact settings.
7. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
8. As-installed control diagrams by control manufacturer.
9. Operating Procedures:
 - a. Routine and normal operating instructions.
 - b. Start-up and shutdown sequences, normal and emergency.
 - c. Safety precautions.
 - d. Special operating instructions.
10. Maintenance Procedures:
 - a. Routine maintenance.
 - b. Guide to troubleshooting.
 - c. Adjustment and checking.
 - d. List of relay settings, control and alarm contact settings.
11. Manufacturer's printed operating and maintenance instructions.
12. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
13. Format: Follow format provided in supplement, Document Section Requirements.

C. Maintenance Summary Forms:

1. Compile individual Maintenance Summary Forms for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format:
 - a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
 - b. Each Maintenance Summary may take as many pages as required.
 - c. Use only 8-1/2-inch by 11-inch size paper.
 - d. Complete using typewriter or electronic printing.

3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
 - a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
 - b. "Unit" is the unit of measure for ordering the part.
 - c. "Quantity" is the number of units recommended.
 - d. "Unit Cost" is the current purchase price.

D. Maintenance Information Database:

1. Compile a list of all equipment. Include all of the following information:
 - a. Project tag name.
 - b. All relevant nameplate information including but not limited to:
 - 1) Manufacturer.
 - 2) Model number.
 - 3) Serial number.
 - 4) Location.
 - 5) Size.
 - 6) Weight.
 - 7) Horsepower.
 - 8) Voltage.
 - 9) Revolutions per minute.
 - c. Maintenance procedures, steps, and frequency.
 - d. Spare parts.
 - e. Lubrication list.
2. Format:
 - a. Information to be entered into Microsoft Excel or Microsoft Access.
 - b. Provide in a single table with one piece of equipment per row.
3. Schedule: Deliver prior to Substantial Completion.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
 - a. Catalog number, size, and composition.
 - b. Color and texture designations.
 - c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
 - a. Manufacturer's recommendation for types of cleaning agents and methods.

- b. Cautions against cleaning agents and methods that are detrimental to product.
- c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture Protection and Weather Exposed Products:

- 1. Manufacturer's data, giving full information on products:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
- 2. Instructions for inspection, maintenance, and repair.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 05 05 23
WELDING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
 - a. BPVC SEC V, Nondestructive Examination.
 - b. BPVC SEC IX, Welding and Brazing Qualifications.
2. American Society of Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
3. ASTM International (ASTM): A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
4. American Welding Society (AWS):
 - a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - b. A3.0, Standard Welding Terms and Definitions.
 - c. D1.1/D1.1M, Structural Welding Code - Steel.
 - d. D1.8/D1.8M, Structural Welding Code - Seismic Supplement.
 - e. D1.2/D1.2M, Structural Welding Code - Aluminum.
 - f. D1.3/1.3M, Structural Welding Code - Sheet Steel.
 - g. D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
 - h. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
 - i. QC1, Standard for AWS Certification of Welding Inspectors.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. Shop and field WPSs and PQRs.
 - b. NDT procedure specifications prepared in accordance with ASME BPVC SEC V.
 - c. Welding Data (Shop and Field): Submit welding data together with Shop Drawings as a complete package.
 - 1) Show on Shop Drawings, or on a weld map, complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.
 - 2) Clearly distinguish between shop and field welds.
 - 3) Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint

welding details showing bevels, groove angles, and root openings for welds.

- 4) Welding and NDE Symbols: In accordance with AWS A2.4.
- 5) Welding Terms and Definitions: In accordance with AWS A3.0.

B. Informational Submittals:

1. WPQs.
2. CWI credentials.
3. Testing agency personnel credentials.
4. CWI visual inspection (VT) reports.
5. Welding Documentation: Submit on forms in referenced welding codes.

1.03 QUALIFICATIONS

- A. WPSs: In accordance with AWS D1.1/D1.1M (Annex M Forms) for shop or field welding; or ASME BPVC SEC IX (Forms QW-482 and QW-483) for shop welding only.
- B. WPQs: In accordance with AWS D1.1/D1.1M (Annex M Forms); or ASME BPVC SEC IX (Form QW-484).
- C. CWI: Certified in accordance with AWS QC1, and having prior experience with specified welding codes. Alternate welding inspector qualifications require prior approval by Engineer.
- D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.04 SEQUENCING AND SCHEDULING

- A. Unless otherwise specified, Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. Contractor's CWI shall be present whenever shop welding is performed. CWI shall perform inspection at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:
 1. Verifying conformance of specified job material and proper storage.
 2. Monitoring conformance with approved WPS.
 3. Monitoring conformance of WPQ.

4. Inspecting weld joint fit-up and performing in-process inspection.
5. Providing 100 percent visual inspection of welds.
6. Coordinating with nondestructive testing personnel and reviewing NDE test results.
7. Maintaining records and preparing reports documenting that results of CWI VT and subsequent NDE testing comply with the Work and referenced welding codes.

PART 3 EXECUTION

3.01 GENERAL

- A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Quality Control Inspection:

1. All Welds: 100 percent VT by Contractor's CWI.
2. Acceptance Criteria:
 - a. Structural Pipe and Tubing: AWS D1.1/D1.1M, Paragraph 9.25.
 - b. All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
 - c. Stud Connections: AWS D1.1/D1.1M, Paragraph 7.8.1.

B. Nondestructive Testing Requirements:

1. NDT frequency shall be as specified below, as required by referenced welding codes, or as specified in the attached table. In case there is a conflict, the higher frequency level of NDT shall apply.
 - a. Nontubular Connections:
 - 1) CJP Butt Joint Groove Welds: Use UT for CJP butt joint groove welds that cannot be readily radiographed.
2. NDT Procedures and Acceptance Criteria:
 - a. Nontubular Connections:
 - 1) RT: Perform in accordance with AWS D1.1/D1.1M, Clause 6, Part E. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.12.1.
 - 2) UT: Perform in accordance with AWS D1.1/D1.1M, Clause 6, Part F. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.13.1.
 - 3) PT and MT:
 - a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.14.4 and Paragraph 6.14.5.

- b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
- b. Tubular Connections:
 - 1) RT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.28 and Paragraph 9.29.
 - 2) UT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.27.
 - 3) PT and MT:
 - a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.14.4 and Paragraph 6.14.5.
 - b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 9.25.

3.03 FIELD QUALITY CONTROL

- A. Contractor's CWI shall be present whenever field welding is performed. CWI shall perform inspection, at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:
 - 1. Verify conformance of specified job material and proper storage.
 - 2. Monitor conformance with approved WPS.
 - 3. Monitor conformance of WPQ.
 - 4. Inspect weld joint fit-up and perform in-process inspection.
 - 5. Provide 100 percent visual inspection of all welds in accordance with Subparagraph Quality Control Inspection.
 - 6. Supervise nondestructive testing personnel and evaluating test results.
 - 7. Maintain records and prepare report confirming results of inspection and testing comply with the Work.

3.04 WELD DEFECT REPAIR

- A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

3.05 SUPPLEMENTS

- A. The supplement listed below, following "End of Section," is a part of this specification.
 - 1. Welding and Nondestructive Testing Table.

END OF SECTION

Welding and Nondestructive Testing						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
03 21 00 Steel Reinforcement	AWS D1.4/D1.4M, Structural Welding Code - Reinforcing Steel	Yes	Yes	Yes	Yes	100% VT and 100% MT of all rebar splices; also see Section 03 21 00
05 50 00 Metal Fabrications	AWS D1.1/D1.1M, Structural Welding Code–Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum or AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel	Yes	Yes	Yes	Yes	100% VT; also see Section 05 50 00
33 05 01.01 Welded Steel Pipe and Fittings	ASME BPV Code, Section IX; and AWS D1.1/D1.1M, Structural Welding Code - Steel	Yes	Yes	Yes	Yes	100% VT; also see Section 33 05 01.01

**SECTION 09 90 00
PAINTING AND COATING**

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Occupational Safety and Health Act (OSHA).
2. The Society for Protective Coatings (SSPC):
 - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 - b. PA 3, Guide to Safety in Paint Applications.
 - c. SP 1, Solvent Cleaning.

1.02 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. HCl: Hydrochloric Acid.
3. MDFT: Minimum Dry Film Thickness, mils.
4. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
5. Mil: Thousandth of an inch.
6. PDS: Product Data Sheet.
7. PSDS: Paint System Data Sheet.
8. PVC: Polyvinyl Chloride.
9. SFPG: Square Feet per Gallon.
10. SFPGPC: Square Feet per Gallon per Coat.
11. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. Data Sheets:
 - 1) Furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and proposed paint color. The PDS form is appended to the end of this section.
 - 2) Furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.

- 3) Technical and performance information that demonstrates compliance with Specification.

B. Informational Submittals:

1. Applicator's Qualification: List of references substantiating experience.
2. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 33 99, Common Product Requirements.
3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
4. Manufacturer's written verification that submitted material is suitable for the intended use.
5. Manufacturer's written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

1.05 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.
- B. Minimum of 5 years' verifiable experience in manufacture of specified product.
- C. Each of the following manufacturers is capable of supplying most of the products specified herein:
1. Tnemec.
 2. Sherwin-Williams

2.02 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Acrylic Latex (Flat)	Flat latex

PART 3 EXECUTION

3.01 PROTECTION OF ITEMS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
- D. Mask openings in motors to prevent paint and other materials from entering.
- E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.02 SURFACE PREPARATION

A. Plastic Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

3.03 SURFACE CLEANING

A. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.04 APPLICATION

A. General:

1. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
2. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.
3. Keep paint materials sealed when not in use.
4. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Film Thickness and Coverage:

1. Number of Coats:
 - a. Minimum required without regard to coating thickness.
 - b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
 - a. Do not exceed coating manufacturer's recommendations.
 - b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Visually inspect plastic surfaces to ensure proper and complete coverage has been attained.

3.05 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. System No. 25 Exposed PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex	2 coats, 320 SFPGPC

1. Use on the following items or areas:
 - a. All exposed-to-view PVC surfaces.
 - b. All PVC exposed directly to outdoor sunlight.

3.06 COLORS

- A. Provide in accordance with County preference.

3.07 FIELD QUALITY CONTROL

- A. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

B. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

C. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.08 CLEANUP

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.
- B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.
- C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.09 SUPPLEMENTS

- A. The supplements listed below, following “End of Section,” are a part of this Specification:
 1. Paint System Data Sheet (PSDS).
 2. Product Data Sheet (PDS).

END OF SECTION

PAINT SYSTEM DATA SHEET

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	Product Name/Number (Proprietary)	Min. Coats, Coverage

PAINT PRODUCT DATA SHEET

Complete and attach manufacturer's Technical Data Sheet to this PDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____

Attach additional sheets detailing manufacturer's recommended storage requirements and holiday testing procedures.

SECTION 26 05 01
ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. Contractor shall visit the site and become familiar with all aspects of this project. Contractor shall coordinate with OWNER and ENGINEER a site visit to become familiar with project scope, Existing Equipment, project conditions, operational needs for area where modifications will take place

- B. Scope
 - 1. Electrical scope includes but not limited to the supply and installation of new mini power center panel board, control panel, associated raceway, conductors, grounding, fasteners, hardware, circuit breakers, and materials to provide a complete power, control, and instrumentation interconnections for a functioning complete system for the operation of valve actuators, signal interfacing, flow transmitters, local and remote-control interconnections.
 - 2. Details are contained on the contract drawings and in further sections of these specifications.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway Transportation Officials (AASHTO).
 - 2. ASTM International (ASTM):
 - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - b. A240/A240M, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 - c. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - d. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - e. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - 3. Electronic Industries Association (EIA/TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 4. Federal Specifications (FS):
 - a. W-C-596, Connector, Electrical, Power, General Specification for.
 - b. W-S-896, Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification).
 - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C62.41, Recommended Practice on Surge Voltages in Low Voltage

- AC Power Circuits.
- b. PC62.41.1, Draft Guide on the Surge Environment in Low Voltage (1000 V and less) AC Power Circuits.
- c. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
- d. 114, Standard Test Procedures for Single-Phase Induction Motors.
- 6. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- 7. National Electrical Contractors Association, Inc. (NECA): 1, Standard Practices for Good Workmanship in Electrical Contracting.
- 8. National Electrical Manufacturers Association (NEMA):
 - a. C80.1, Rigid Steel Conduit-Zinc Coated.
 - b. C80.3, Electrical Metallic Tubing-Zinc Coated.
 - c. C80.6, Intermediate Metal Conduit-Zinc Coated (IMC).
 - d. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - e. CC1, Electrical Power Connectors for Substations.
 - f. ICS 1, Industrial Control and Systems: General Requirements.
 - g. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - h. ICS 2.3, Industrial Control and Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
 - i. MG 1, Motors and Generators.
 - j. PB 1, Panel boards.
 - k. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - l. ST 20, Dry Type Transformers for General Applications.
 - m. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - n. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 - o. WC 55, Instrumentation Cables and Thermocouple Wire.
 - p. WC 70, Standard for Non-Shielded Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy.
 - q. WC 71, Standard for Non-Shielded Cables Rated 2001-5000 Volts for use in the Distribution of Electrical Energy.
 - r. WC 74, 5-46 KV Shielded Power Cable for use in the Transmission and Distribution of Electric Energy.
 - s. WD 1, General Color Requirements for Wiring Devices.
- 9. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- 10. Underwriters Laboratories, Inc. (UL):
 - a. 1, Flexible Metal Conduit.
 - b. 6, Electrical Rigid Metal Conduit—Steel.
 - c. 13, Power-Limited Circuit Cables.
 - d. 44, Thermoset Insulated Wires and Cables.
 - e. 62, Flexible Cord and Fixture Wire.
 - f. 67, Panel boards.
 - g. 98, Enclosed and Dead-Front Switches.
 - h. 198C, High Interrupting Capacity Fuses, Current Limiting Types.
 - i. 198E, Class R Fuses.

- j. 360, Liquid-Tight Flexible Steel Conduit.
- k. 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- l. 486C, Splicing Wire Connectors.
- m. 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
- n. 508, Industrial Control Equipment.
- o. 510, Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
- p. 514B, Fittings for Cable and Conduit.
- q. 651, Schedule 40 and 80 PVC Conduit.
- r. 674, Electric Motors and Generators for use in Division 1 Hazardous (Classified) Locations.
- s. 797, Electrical Metallic Tubing.
- t. 854, Service-Entrance Cables.
- u. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
- v. 943, Ground-Fault Circuit Interrupters.
- w. 1059, Terminal Blocks.
- x. 1242, Intermediate Metal Conduit.
- y. 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
- z. 1449, Transient Voltage Surge Suppressors.
- aa. 1561, Dry-Type General Purpose and Power Transformers.
- bb. 2111, Overheating Protection for Motors.

1.03 SUBMITTALS

A. Action Submittals:

- 1. Mini Power Center
- 2. Circuit Breakers
- 3. Transformers
- 4. Control Panel
- 5. Raceway
- 6. Conductors
- 7. Pull and Junction Boxes
- 8. Hangers and Hardware
- 9. Basic Materials
- 10. Terminations, terminal strips and compression fittings
- 11. Terminations
- 12. Fittings, nipples, lock nuts, bushings.
- 13. Heat Shrink and Heat Shrink and wire markers
- 14. Raceway Markers

B. Informational Submittals:

- 1. Field test reports.
- 2. Job Photographs
- 3. Sequence of installation plan.
- 4. Record Drawings including terminal numbers in AutoCAD 2016 DWG file electronic format
- 5. Schedule
- 6. Signed permits indicating Work is acceptable to regulatory authorities

- having jurisdiction.
7. Operation and Maintenance Data:
 - a. Provide record drawing and operation and maintenance manuals for new equipment installed under this contract.
 - b. Minimum information shall include manufacturer's preprinted instruction manual, one copy of the approved submittal information for the item, tabulation of any settings, and copies of any test reports.

1.04 APPROVAL BY AUTHORITY HAVING JURISDICTION (WHEN REQUIRED)

- A. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.
- B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark or label.

1.05 QUALIFICATIONS

- A. Journeyman Electrician with proven track record in the installation of industrial water plant equipment. Provide resumes upon request.
- B. Testing Qualifications: Electrician NETA Certified.

PART 2 PRODUCTS

2.01 GENERAL

- A. Products shall comply with all applicable provisions of NFPA 70.
- B. Like Items of Equipment: End products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.
- C. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.
- D. Equipment Finish:
- E. Manufacturer's standard finish color, except where specific color is indicated.

2.02 PULL AND JUNCTION BOXES

- A. NEMA 4 X fiberglass reinforced or 316 stainless steel
 1. Cover: Gasketed, weatherproof, and hinged with stainless steel hardware
 2. Hubs: Threaded MEYERS type for all raceway terminations

3. Manufacturers and Products, Nonhazardous Locations:
 - a. Hoffman or equal

2.03 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

- A. Type: Heavy-duty, oil-tight. Provide contact arrangements, colors, inscriptions, and functions as shown.
- B. Contact Rating: NEMA ICS 2, Type A600.
- C. Unless otherwise shown, provide the following features:
 1. Selector Switch Operating Lever: Standard.
 2. Indicating Lights: Push-to-test, transformer-type.
 3. Pushbutton Color:
 - a. ON or START: Black.
 - b. OFF or STOP: Red.
 4. Pushbuttons and selector switches lockable in OFF position where indicated.
- D. Legend Plate:
 1. Material: Plastic
 2. Engraving: Indicating specific function, or as shown.
 3. Letter Height: 7/64 inch.
- E. Manufacturers and Products:
 1. General Electric Co.; Type CR 104P.
 2. Square D Co.; Type T.
 3. Eaton; Type 10250T.

2.04 TERMINAL BLOCKS

- A. Type: UL 1059. Compression screw clamp, with current bar providing direct contact with wire and yoke, with individual rail mounted terminals. Marking system shall permit use of preprinted or field-marked tags.
- B. Yokes and Clamping Screws: Zinc-plated, hardened steel.
- C. Rating: 600V ac.
- D. Manufacturers:
 1. Weidmuller, Inc.
 2. Ideal.

2.05 MAGNETIC CONTROL RELAYS

- A. NEMA ICS 2, Class A600 (600 volts, 10 amperes continuous, 7,200VA make, 720VA break), machine tool type with field convertible contacts.

- B. Manufacturer and Model:
 - 1. Eaton; Type M 600.
 - 2. General Electric; Type CR120B.

2.06 TIME DELAY RELAY

- A. Industrial Relay Rated: 150 volts, 5 amps continuous, (3600 VA make, 360 VA break).
- B. Solid-state electronic, field convertible ON/OFF delay.
- C. Two Form C contacts (minimum).
- D. Repeat accuracy plus or minus 2 percent.
- E. Timer Adjustment: Multiple adjustable ranges, including 1 second to 60 seconds, unless otherwise shown.
- F. Manufacturers:
 - 1. Omron.
 - 2. Eaton.
 - 3. General Electric Co.
- G. Mini Power Center
 - 1. 15 KVA 480 V 1 phase primary/ with 120/240 1 phase secondary
 - 2. Enclosure NEMA 3 /R hinged with interior dead front cover.
 - 3. Circuit Breakers supplied as part of mini- power center Provide 1 /2 pole 30 A and 10/ 1 pole 20 Amp minimum
 - 4. Provide X/O tap lug for external grounding of transformer
 - a. Manufacturer: EATON P48G11S1526 OR EQUAL

2.07 SUPPORT AND FRAMING CHANNELS

- A. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12 gauge.
- B. Manufacturers:
 - 1. B Line Systems, Inc.
 - 2. Unistrut Corp.

2.08 NAMEPLATES

- A. Material: Laminated plastic.
- B. Attachment: stainless screws.
- C. Color: Black, engraved to a white core, or as shown.

- D. Engraving:
 - 1. Devices and Equipment: Name or tag shown, or as required.
 - 2. Panelboards:
 - a. Designation.
 - b. Service voltage.
 - c. Phases.
 - 3. Minimum Requirement: Label metering and power distribution equipment, local control panels, junction boxes, motor controls, and transformers.
- E. Letter Height:
 - 1. Pushbuttons, Selector Switches, and Other Devices: 1/8 inch.
 - 2. Equipment and Panelboards: 1/4 inch.

2.09 CONDUIT AND FITTINGS

- A. PVC Schedule 80
 - 1. UL Listed rated for 105 C conductors water tight bell end with all factory fittings , elbows, couplings male adapters
- B. Rigid Galvanized Steel Conduit (RGS):
 - 1. Meet requirements of NEMA C80.1 and UL 6.
 - 2. Material: Hot-dip galvanized, with chromated protective layer.
 - 3. Material: Hot-dip galvanized, with chromated and lacquered protective layer
- C. Flexible Metal, Liquid-Tight Conduit:
 - 1. UL 360 listed for 105 degrees C insulated conductors.
 - 2. Material: Galvanized steel, with an extruded PVC jacket.
- D. Flexible Coupling, Hazardous Locations:
 - 1. Approved for use in the atmosphere involved.
 - 2. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.
 - 3. Outer bronze braid and an insulating liner.
 - 4. Conductivity equal to a similar length of rigid metal conduit.
 - 5. Manufacturers and Products:
 - a. Crouse-Hinds; Type ECGJH or ECLK.
 - b. Appleton; EXGJH or EXLK.
- E. Fittings:
 - 1. Provide bushings, grounding bushings, conduit hubs, conduit bodies, couplings, unions, conduit sealing fittings, drain seals, drain/breather fittings, expansion fittings, and cable sealing fittings, as applicable.
 - 2. Rigid Galvanized Steel and Intermediate Metal Conduit:
 - a. Meet requirements of UL 514B.

- b. Type: Threaded, galvanized.
- c. e XJG.
- 3. Flexible Metal, Liquid-Tight Conduit:
 - a. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
 - b. Insulated throat and sealing O rings.
- 4. Flexible Coupling, Hazardous Locations:
 - a. Approved for use in the atmosphere involved.
 - b. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.
 - c. Outer bronze braid and an insulating liner.
 - d. Conductivity equal to a similar length of rigid metal conduit.
 - e. Manufacturers and Products:
 - 1) Crouse-Hinds; Type ECGJH or ECLK.
 - 2) Appleton; EXGJH or EXLK.

2.10 CONDUIT ACCESSORIES

A. Identification Devices:

- 1. Raceway Tags:
 - a. Material: Permanent, nonferrous metal
 - b. Shape: Round.

2.11 CONDUCTORS AND CABLES

A. Conductors 600 Volts and Below:

- 1. Conform to applicable requirements of NEMA WC 71, WC 72, and WC 74.
- 2. Conductor Type:
 - a. Power
- 3. Insulation: THWN r
 - a. Conform to physical and minimum thickness requirements of NEMA WC 70.
- 4. Flexible Cords and Cables:
 - a. Type SOW A/50 with ethylene propylene rubber insulation in accordance with UL 62.
 - b. Conform to physical and minimum thickness requirements of NEMA WC 70.

B. 600 Volt Rated Cable:

- 1. General:
 - a. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 20,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
 - b. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
 - c. Suitable for installation in open air, in cable trays, or conduit.
 - d. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
 - e. Overall Outer Jacket: [PVC, flame-retardant, sunlight- and oil-

- resistant] [Hypalon (chlorosulfonated polyethylene)].
- 2. Type TSP, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.
 - a. Outer Jacket: 45 mils nominal thickness.
 - b. Individual Pair Shield: 1.35 mils, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
 - c. Dimension: 0.31 inch nominal outside diameter.
 - d. Conductors:
 - 1) Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
 - 2) 20 AWG, seven-strand tinned copper drain wire.
 - 3) Insulation: 15 mils nominal PVC.
 - 4) Jacket: 4 mils nominal nylon.
 - 5) Color Code: Pair conductors black and red.
 - e. Manufacturers: Okonite Co.
- 3. CAT 5
 - a. Four Pair 24 AWG Stranded Copper PVC Jacket Cat 5 E Shielded and Unshielded Cable Belden P/N Reference (7924A, 7939A)
- 4. Quality Assurance
 - a. Except as otherwise stated herein, the industrial Ethernet cables furnished in accordance with the specification shall comply with the latest applicable codes and standards of the American National Standards Institute (ANSI), the Telecommunications Industry Association (TIA), the International Standardization Organization (ISO), the International Electro technical Commission (IEC), the Institute of Electrical and Electronic Engineers (IEEE), the National Electrical Manufacturers Association (NEMA), the American Society for Testing and Materials (ASTM), and Underwriters Laboratory (UL).
 - b. As a minimum, the latest edition of the following individual standards shall apply:
 - 1) ANSI/TIA/EIA-568-B
 - 2) ISO/IEC 11801
 - 3) UL444, UL1666, UL1581
 - 4) ASTM B-3, B-8, B-33, B-470
 - 5) IEEE 802.3
 - 6) NFPA 70 NEC
 - 7) CSA C22.1-06 CEC

C. Accessories:

- 1. Tape:
 - a. general Purpose, Flame Retardant: 7 mils, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
 - b. Flame Retardant, Cold and Weather Resistant: 8.5 mils, vinyl plastic, Scotch Brand 88.
 - c. Arc and Fireproofing:
 - 1) 30 mils, elastomer.
 - 2) Manufacturers and Products:

- a) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tape binder.
 - b) Plymout; Plyarc 53, with Plyglas 77 glass cloth tape binder.
- 2. Identification Devices:
 - a. Sleeve-type, permanent, PVC, yellow or white, with legible machine-printed black markings.
 - b. Manufacturer and Products: Raychem; Type D SCE or ZH SCE.
- 3. Connectors and Terminations:
 - a. Nylon, Self-Insulated Crimp Connectors:
 - 1) Manufacturers and Products:
 - a) Thomas & Betts; Sta-Kon.
 - b) Burndy; Insulug.
 - c) ILSCO.
- 4. Self-Insulated, Freespring Wire Connector (Wire Nuts):
 - a. Plated steel, square wire springs.
 - b. UL Standard 486C.
 - c. Manufacturers and Products:
 - 1) Thomas & Betts.
 - 2) Ideal; Twister.
- 5. Cable Lugs:
 - a. In accordance with NEMA CC 1.
 - b. Rated 600 volts of same material as conductor metal.
 - c. Uninsulated Crimp Connectors and Terminators:
 - 1) Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
 - 2) Manufacturers and Products:
 - a) Thomas & Betts; Color-Keyed.
 - b) Burndy; Hydent.
 - c) ILSCO.
 - d. Uninsulated, Bolted, Two-Way Connectors and Terminators:
 - 1) Manufacturers and Products:
 - a) Thomas & Betts; Locktite.
 - b) Burndy; Quiklug.
 - c) ILSCO.
- 6. Cable Ties:
 - a. Nylon, adjustable, self-locking, and reusable.
 - b. Manufacturer and Product: Thomas & Betts; TY RAP.
- 7. Heat Shrinkable Insulation:
 - a. Thermally stabilized, crosslinked polyolefin.
 - b. Manufacturer and Product: Thomas & Betts; SHRINK-KON.

2.12 GROUNDING

- A. Ground all enclosures, new framing channels, interior back plates, enclosures and all metal parts to A/C ground run within each equipment room. Minimum size shall be # 6 copper stranded but shall me article 250 of the NEC. All metallic raceways installed shall contain a grounding bushing with a # 6 stranded bond wire tied to the common ground. Ground Mini-Power Center with bare number #3 tied to plant grid as shown on drawings.

- B. Compression Type:
 - 1. Compress-deforming type; wrought copper extrusion material.
 - 2. Single indentation for conductors 6 AWG and smaller.
 - 3. Double indentation with extended barrel for conductors 4 AWG and larger.
 - 4. Single barrels prefilled with oxide-inhibiting compound.
 - 5. Manufacturers:
 - a. Burndy Corp.
 - b. Thomas and Betts Co.
 - c. ILSCO.

- C. Mechanical Type:
 - 1. Split-bolt, saddle, or cone screw type; copper alloy material.
 - 2. Manufacturers:
 - a. Burndy Corp.
 - b. Thomas and Betts Co.

PART 3 EXECUTION

3.01 GENERAL

- A. Install materials and equipment in accordance with manufacturer's instructions and recommendations.
- B. Work shall comply with all applicable provisions of NECA 1.
- C. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous areas shown.
- D. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

3.02 DEMOLITION

- A. General Demolition:
 - 1. Remove all existing raceways ,conductors, equipment and associated materials from existing flow signal equipment with care and turn over to the owner. Prior to any demolition obtain onsite agreement as to what equipment shall be removed and where equipment shall be stored. Move removed equipment and materials into owner storage area as instructed by owner.

3.03 PROTECTION FOLLOWING INSTALLATION

- A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation.
- B. Cap conduit runs during construction with manufactured seals.
- C. Close openings in boxes or equipment during construction.

- D. Energize space heaters furnished with equipment.

3.04 JUNCTION AND PULL BOXES

- A. Install where necessary to terminate, tap-off, or redirect multiple conduit runs.
- B. Install pull boxes where necessary in raceway system to facilitate conductor installation.
- C. Mounting Hardware:
 - 1. Outdoor or Noncorrosive Indoor Wet Areas: Stainless steel.
 - 2. Corrosive Areas: Stainless steel.
- D. Location/Type:
 - 1. All locations NEMA 4 X unless otherwise shown.

3.05 SUPPORT AND FRAMING CHANNELS

- A. Install where required for mounting and supporting electrical equipment and raceway systems.
- B. Channel Type:
 - 1. Interior, Wet or Dry Corrosive Locations: Type 316 stainless steel.
 - 2. Outdoor, Corrosive Locations: Type 316 stainless steel.

3.06 NAMEPLATES

- A. Provide identifying nameplate on all equipment.

3.07 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) EQUIPMENT

- A. Install in accordance with manufacturer's instructions, including lead length, overcurrent protection, and grounding.

3.08 CONDUIT AND FITTINGS

- A. General:
 - 1. Crushed or deformed raceways not permitted.
 - 2. Maintain raceway entirely free of obstructions and moisture.
 - 3. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
 - 4. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
 - 5. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
 - 6. Group raceways installed in same area.
 - 7. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
 - 8. Run exposed raceways parallel or perpendicular to walls, structural

members, or intersections of vertical planes.

B. Conduit Application:

1. Galvanized Rigid steel with threaded connections within pump room
2. Schedule 80 PVC in areas outside pump room

3.09 CONDUCTORS AND CABLES

A. Conductor storage, handling, and installation shall be in accordance with manufacturer's recommendations.

B. Do not exceed manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

C. Conduit system shall be complete prior to drawing conductors. Lubricate prior to pulling into conduit. Lubrication type shall be as approved by conductor manufacturer.

D. Terminate all conductors and cables, unless otherwise shown.

E. Do not splice conductors, unless specifically indicated or approved by Engineer.

F. Wiring within Equipment and Local Control Panels: Remove surplus wire, dress, bundle, and secure.

G. Power Conductor Color Coding:

1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1 1/2 to 2 inches wide.
2. 8 AWG and Smaller: Provide colored conductors.
3. Colors:
 - a. Neutral Wire: White.
 - b. Live Wires, 120/240 Volt, Single-Phase System: Black, red.
 - c. Live Wires, 120/208 Volt, Three-Phase System: Black, red, or blue.
 - d. Live Wires, 277/480 Volt, Three-Phase System: Brown, orange, or yellow.
 - e. Ground Wire: Green.

H. Circuit Identification:

1. Identify power, instrumentation, and control conductor at each termination.
2. Method: Identify with sleeves. Taped-on markers or tags relying on adhesives not permitted.
3. Connections and Terminations:
 - a. All terminations shall be compression lugs for larger power conductors and crimp type connectors for control and signal conductors. All control conductors shall terminate with in terminal strips
 - b. Wire nuts are not permitted.
4. Install crimp connectors and compression lugs with tools approved by

connector manufacturer.

3.10 GROUNDING

- A. Grounding shall be in compliance with NFPA 70 and as shown.
- B. Bond together system equipment enclosures, back plates, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and enclosure doors. Minimum bonding conductor # 6 bare stranded unless otherwise noted. Ground neutral terminal of the Mini-Power center to the plant grid as shown on the drawings.
- C. Shielded Instrumentation Cables:
 - 1. Ground shield to ground bus at power supply for analog signal.
 - 2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
 - 3. Do not ground instrumentation cable shield at more than one point.
- D. Equipment Grounding Conductors: Provide in all conduits containing power conductors and control circuits above 50 volts.

3.11 LOW VOLTAGE MOTOR CONTROL

- A. Install equipment in accordance with NEMA ICS 2.3 and manufacturer's instructions and recommendations.
- B. Field adjust trip settings of motor starter magnetic-trip-only circuit breakers. Adjust to approximately 11 times motor rated current.
- C. Select and install overload relay heaters or adjust electronic overload protection after the actual nameplate full-load current rating of motor has been determined.

3.12 FIELD QUALITY CONTROL

- A. General:
 - 1. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.
 - 2. Test instrument calibration shall be in accordance with NETA ATS.
 - 3. Perform inspection and electrical tests after equipment has been installed.
 - 4. Perform tests with apparatus de-energized whenever feasible.
 - 5. Inspection and electrical tests on energized equipment are to be:
 - a. Scheduled with Engineer and OWNER prior to de-energization.
 - b. Minimized to avoid extended period of interruption to the operating plant equipment.
- B. Tests and inspection shall establish that:
 - 1. Electrical equipment is operational within industry and manufacturer's tolerances.
 - 2. Installation operates properly.

3. Equipment is suitable for energization.
 4. Installation conforms to requirements of Contract Documents and NFPA 70.
- C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.
- D. Adjust mechanisms and moving parts for free mechanical movement.
- E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.
- F. Verify nameplate data for conformance to Contract Documents.
- G. Realign equipment not properly aligned and make sure equipment is level.
- H. Properly anchor electrical equipment found to be inadequately anchored.
- I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.
- J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.
- K. Provide proper lubrication of applicable moving parts.
- L. Investigate and repair or replace:
1. Electrical items that fail tests.
 2. Active components not operating in accordance with manufacturer's instructions.
 3. Damaged electrical equipment.
- M. Electrical Enclosures:
1. Remove foreign material and moisture from enclosure interior.
 2. Vacuum and wipe clean enclosure interior.
 3. Remove corrosion found on metal surfaces.
 4. Repair or replace, as determined by Engineer, door and panel sections having damaged surfaces.
 5. Replace missing or damaged hardware.
- N. Provide certified test report(s) documenting the successful completion of specified testing. Include field test measurement data.
- O. Test the following equipment and materials:
1. Conductors: Insulation resistance, No. 4 and larger only meg with 1000-volt megger record values with each conductor identified as to phase location and equipment served. Submit test report to Engineer
 2. Mini Power Center, switches, and circuit breakers.
 3. Meg Ohm Motor controls.
 4. Meg Ohm Grounding electrodes.

5. Motors.

P. Controls

1. Test control and signal wiring for proper termination and function.
2. Test local control panels and other control devices for proper terminations, configuration and settings, and functions.
3. Demonstrate control, monitoring, and indication functions in presence of Owner and Engineer.

Q. Balance electrical load between phases on panel boards and mini-power centers after installation.

R. Voltage Testing:

1. When installation is complete and facility is in operation, check voltage at point of termination of electric utility supply system to Project.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. If unbalance exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded conditions more than plus or minus 4 percent of nominal, make written request to electric utility to correct condition.
4. If corrections are not made, obtain written statement from a responsible electric utility official that voltage variations and/or unbalance are within their normal standards.

S. Equipment Line Current:

1. Check line current in each phase for each piece of equipment.
2. If electric utility makes adjustments to supply voltage magnitude or balance, make line current check after adjustments are made.

3.13 SUPPLEMENTS

A. CONTRACT DRAWINGS

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Institute of Electrical and Electronics Engineers (IEEE):
 - a. C62.1, Surge Arresters for Alternating Current Power Circuits.
 - b. C62.11, Standards for Metal-Oxide Surge Arrestors for AC Power Circuits.
 2. National Electrical Contractor's Association (NECA): 407, Recommended Practice for Installing and Maintaining Panelboards.
 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. 289, Application Guide for Ground Fault Circuit Interrupters.
 - c. AB 1, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - d. KS 1, Enclosed Switches
 - e. LA 1, Surge Arrestors.
 - f. PB 1, Panelboards.
 - g. PB 1.1, General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 5. Underwriters Laboratories Inc. (UL):
 - a. 67, Standard for Panelboards.
 - b. 98, Standard for Enclosed and Dead-Front Switches.
 - c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
 - d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
 - e. 508, Standard for Industrial Control Equipment.
 - f. 870, Wireways, Auxiliary Gutters and Associated Fittings.
 - g. 943, Standard for Ground-Fault Circuit-Interrupters.

1.02 SUBMITTALS

- A. Action Submittals:
1. Manufacturer's data sheets for each type of panelboard, protective device, accessory item, and component.
 2. Manufacturer's shop drawings including dimensioned plan, section, and elevation for each panelboard type, enclosure, and general arrangement.

3. Tabulation of features for each panelboard to include the following:
 - a. Protective devices with factory settings.
 - b. Provisions for future protective devices.
 - c. Space for future protective devices.
 - d. Voltage, frequency, and phase ratings.
 - e. Enclosure type.
 - f. Bus and terminal bar configurations and current ratings.
 - g. Provisions for circuit terminations with wire range.
 - h. Short circuit current rating of assembled panelboard at system voltage.
 - i. Features, characteristics, ratings, and factory settings of auxiliary components.

B. Informational Submittals: Manufacturer's recommended installation instructions.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled as defined in NEC Article 100.

1.04 EXTRA MATERIALS

A. Extra Materials: Furnish, tag, and box for shipment and storage the following spare parts, special tools, and material:

<u>Item</u>	<u>Quantity</u>
Touch-up paint for panelboards	One half-pint container

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of.

1. Square D Co.
2. Eaton/Cutler-Hammer.

2.02 GENERAL

A. Provide low voltage panelboards for application at 600V or less in accordance with this section.

B. Provide equipment in accordance with NEMA PB 1, NFPA 70, and UL 67.

C. Wire Terminations:

1. Panelboard assemblies, including protective devices, shall be suitable for use with 75 degrees C or greater wire insulation systems at NEC 75 degrees C conductor ampacity.
2. In accordance with UL 486E.

D. Load Current Ratings:

1. Unless otherwise indicated, load current ratings for panelboard assemblies, including bus and circuit breakers, are noncontinuous as defined by NEC. Continuous ratings shall be 80 percent of noncontinuous rating.
2. Where indicated "continuous," "100 percent," etc., selected components and protective devices shall be rated for continuous load current at value shown.

E. Short Circuit Current Rating (SCCR): Integrated equipment short circuit rating for each panelboard assembly shall be no less than the following:

1. Minimum SCCR at 208Y/120 or 120/240 volts shall be 22,000 amperes rms symmetrical.
2. Minimum SCCR at 480Y/277 volts shall be 44,000 amperes rms symmetrical.

F. Overcurrent Protective Devices:

1. In accordance with NEMA AB 1, NEMA KS 1, UL 98, and UL 489.
2. Protective devices shall be adapted to panelboard installation.
 - a. Capable of device replacement without disturbing adjacent devices and without removing main bus.
 - b. Spaces: Cover openings with easily removable cover.
3. Series-Connected Short Circuit Ratings: Devices shall be fully rated; series-connected ratings unacceptable.

G. Circuit Breakers:

1. General: UL 489 Thermal-magnetic unless otherwise indicated, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.
2. Noninterchangeable: In accordance with NEC.
3. Bus Connection: Bolt-on circuit breakers in 480Y/277-volt, and plug-in circuit breakers in 208Y/120 and 240/120-volt branch circuit panelboards.
4. Trip Mechanism:
 - a. Individual permanent thermal and magnetic trip elements in each pole.

- b. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
 - c. Two and three pole, common trip.
 - d. Automatically opens all poles when overcurrent occurs on one pole.
 - e. Test button on cover.
 - f. Calibrated for 40 degrees C ambient, unless shown otherwise.
5. Unacceptable Substitution:
 - a. Do not substitute single-pole circuit breakers with handle ties for multi-pole breakers.
 - b. Do not use tandem or dual circuit breakers in normal single-pole spaces.
 6. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).
 - a. Ground fault sensor shall be rated same as circuit breaker.
 - b. Push-to-test button.
 - c. Reset button.

H. Enclosures:

1. Provide as specified in Section 26 05 04, Basic Electrical Materials and Methods. NEMA 1 enclosures shall be provided for all panelboards located in air conditioned Electrical Rooms. NEMA 4X stainless steel enclosures shall be provided for all panelboards that are located outside. Material: Type 1, Type 3R, and Type 3S shall be code-gauge, hot-dip galvanized sheet steel with reinforced steel frame.
2. Finish: Rust inhibitor prime followed by manufacturer's standard gray baked enamel or lacquer.
3. Interior:
 - a. Factory assembled; complete with circuit breakers.
 - b. Spaces: Cover openings with easily removable metal cover.
4. Locking Device:
 - a. Flush type.
 - b. Doors Over 30 Inches in Height: Multipoint.
 - c. Identical keylocks, with two milled keys each lock.
5. Circuit Directory: Metal frame with transparent plastic face and enclosed card on interior of door

I. Bus:

1. Material: Copper full sized throughout length of each section
2. Buss shall be split buss design with each section rated at 100A/3 pole with 100A 3 pole main breaker.

3. Provide for mounting of future protective devices along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.
- J. Feeder Lugs: Main in each section, and neutral shall be replaceable, bolted mechanical or crimp compression type.
- K. Equipment Ground Terminal Bus: Copper with suitably sized provisions for termination of ground conductors, and bonded to box.
1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
 2. Provide individual termination points for all other grounding conductors such as feeder, grounding electrode, etc.
- L. Neutral Terminal Bus: Insulated, Copper with suitably sized provisions for termination of neutral conductors, and isolated from box.
1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
 2. Provide individual termination points for all other neutral conductors.
 3. Termination points shall be bolted crimp compression lugs for conductors 6 AWG and larger.
 4. Oversize Neutral: Provide oversized neutral terminal bus as indicated.
- M. Surge Protection:
1. Integral to panelboard.
 2. Surge Current Rating: 120kA, minimum.
 3. Connection: Bus.
- N. Location: Panelboard interior.
- O. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances for future protective device ampere ratings indicated.

2.03 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

- A. Protective Device Locking: Furnish provisions for handle padlocking for main and subfeed devices; also provide for branch devices where indicated.
- B. Multi-Section Panelboards: Where more than one section is otherwise indicated, provide multiple panelboards with separate fronts.
1. Panelboard sections shall be individually installed and field interconnected to form a single electrical unit.

2. Unless otherwise indicated, provide feed-through lugs on each section but last.
3. Surface-mount panels shall be individually mounted and may be different sizes.
4. Recessed-mount panels shall be individually mounted and the same size tub and flush cover.
5. Surface-mount multi-section panelboards may be comprised of sections of unequal heights.
6. Provide feed-through and main lugs in individual sections as required for field assembly of a complete multi-section panelboard.
7. Provide neutral and ground terminal bars in each section.

C. NEMA 250 Type 1 Branch Panelboard Enclosure:

1. Front trim shall be secured to box with concealed trim clamps.
2. Surface-mount panelboard front trim shall have same dimensions as box.
3. Flush panelboards front trims shall overlap box nominal 3/4 inch on all sides.
4. Door in panelboard front trim, with concealed hinges, shall provide access to protective device operating handles.
5. Doors over 30 inches in height shall have multi-point latching.
6. Door lock shall be secure with flush catch and tumbler lock; all panelboards keyed alike, with two milled keys each lock.
7. Circuit Directory: Metal frame with transparent plastic face and enclosed card, mounted inside each panel door.
8. Provide sign 2-inch high letters white on black plastic designating panelboard name as shown.
9. Provide warning sign 3-inch Letters RED ON WHITE
WARNING PANELBOARD IS FED FROM 'TWO SOURCES
SWITCHBOARD E AND SWITCHBOARD H'

2.04 POWER DISTRIBUTION PANELBOARDS

A. Branch Protective Devices:

1. Locking: Furnish devices with provisions for handle padlocking.
2. Load Connections: Wire lugs shall be mechanical or crimp compression type, removable/replaceable, and suitable for 75 degrees C rated conductors without derating switch nor conductor ampacity.
3. Provide a nameplate for each circuit, blanks for spares.

PART 3 EXECUTION

3.01 GENERAL

- A. Install in accordance with NECA 407, NEMA PB 1.1 and manufacturers' written installation instructions.
- B. Install securely, plumb, in-line and square with walls.
- C. Install top of cabinet trim 78 inches above floor, unless otherwise shown. Install cabinet so tops of protective device operating handles are no more than 78 inches above the floor.
- D. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289.
- E. Install filler plates in unused spaces.
- F. Wiring in Panel Gutters: Train conductors neatly in groups; bundle, and wrap with nylon wire ties.

3.02 BRANCH CIRCUIT PANELBOARD

- A. Mount flush panels uniformly flush with wall finish.
- B. Provide typewritten circuit directory for each panelboard.

3.03 POWER DISTRIBUTION PANELBOARD

- A. Provide engraved identification for each protective device.
- B. Phase each section of the Split Buss and each respective main so that all three phases of each section are in sequence. Regardless of which source is utilized.

END OF SECTION

SECTION 33 13 00
DISINFECTION OF WATER FACILITIES

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Water Works Association (AWWA):
 - a. B300, Hypochlorites.
 - b. B301, Liquid Chlorine.
 - c. B302, Ammonium Sulfate.
 - d. B303, Sodium Chlorite.
 - e. C651, Disinfecting Water Mains.
 - f. C652, Disinfection of Water Storage Facilities.
 - g. C653, Disinfection of Water Treatment Plants.
 2. NSF International (NSF):
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
 - b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
 3. Standard Methods for the Examination of Water and Wastewater, as published by American Public Health Association, American Water Works Association, and the Water Environment Federation.

1.2 SUBMITTALS

- A. Informational Submittals:
1. Plan describing and illustrating conformance to appropriate AWWA standards and this Specification.
 2. Procedure and plan for cleaning system.
 3. Procedures and plans for disinfection and testing.
 4. Proposed locations within system where samples will be taken.
 5. Type of disinfecting solution and method of preparation.
 6. Method of disposal for highly chlorinated disinfecting water.

1.3 QUALITY ASSURANCE

- A. Independent Testing Agency: not used. Note that SCRWTP uses chlorine gas and this product cannot be used for piping assembly disinfection.

1.4 SEQUENCING

- A. Commence disinfection after completion of following:
1. Cleaning of piping assemblies.
 2. Completion and acceptance of internal painting of system(s).
 3. Hydrostatic and pneumatic testing, pressure testing, functional and performance testing and acceptance of pipelines, pumping systems, structures, and equipment.

PART 2 PRODUCTS

2.1 GENERAL

- A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

2.2 WATER FOR DISINFECTION AND TESTING

- A. Clean, uncontaminated, and potable.
- B. Owner will supply potable quality water. Contractor shall convey in disinfected pipelines or containers to the point of application.

2.3 DISINFECTANT

- A. The following disinfectant product(s) shall not be used: chlorine gas.

PART 3 EXECUTION

3.1 GENERAL

- A. Conform to AWWA C651 for pipes and pipelines, C652 for tanks and reservoirs and C653 for water treatment plants and filters, except as modified in these Specifications.
- B. Contractor's Equipment:
 - 1. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
 - 2. Water used to fill pipeline may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connections as required by AWWA C651.
- C. Disinfect the following items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
 - 1. Fittings and valves.
 - 2. Pipelines: Disinfect new pipelines that connect to existing pipelines up to point of connection.
 - 3. Disinfect surfaces of materials that will contact finished water, both during and following construction, using one of the methods described in AWWA C652 and AWWA C653. Disinfect prior to contact with finished water. Take care to avoid recontamination following disinfection.
- D. Prior to application of disinfectants, clean pipeline assemblies of loose and suspended material.

- E. Allow freshwater and disinfectant solution to flow into pipe or vessel at a measured rate so chlorine-water solution is at specified strength. Do not place concentrated liquid commercial disinfectant in pipeline or other facilities to be disinfected before it is filled with water.

3.2 TURBIDITY

- A. Cleaning of equipment and facilities shall include removal of materials that result in a turbidity exceeding limits stated in Article Testing.

3.3 PIPING

- A. Cleaning:
 1. Before disinfecting, clean foreign matter from pipe in accordance with AWWA C651.
 2. If continuous feed method or slug method of disinfection, as described in AWWA C651, are used flush pipelines with potable water until clear of suspended solids and color. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties.
 3. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections. Operate valves during flushing process at least twice during each flush.
 4. Flush pipe through flushing branches and remove branches after flushing is completed.
 5. Pipeline shall be cleaned by use of a pipe pig specifically designed for cleaning. Observe material removed by pig on each pass. Repeat process until pipe has been cleaned to the satisfaction of Engineer.
- B. Disinfecting Procedure: In accordance with AWWA C651, unless herein modified.
- C. Pipelines larger than 24-inch may be disinfected by spraying in accordance with method described in AWWA C652.

3.4 PUMPS

- A. Not used.

3.5 TANKS AND RESERVOIRS

- A. Not used.

3.6 FILTERS

- A. Not used.

3.7 DISPOSAL OF CHLORINATED WATER

- A. Do not allow flow into a waterway without neutralizing disinfectant residual.
- B. See appendix of AWWA C651, C652 and C653 for acceptable neutralization methods.

3.8 TESTING

- A. Collection of Samples:
 - 1. Coordinate activities to allow Samples to be taken in accordance with this Specification.
 - 2. Provide valves at sampling points.
 - 3. Provide access to sampling points.
- B. Test Equipment:
 - 1. Clean containers and equipment used in sampling and make sure they are free of contamination.
 - 2. Obtain sampling bottles with instructions for handling from Owner's laboratory.
- C. Chlorine Concentration Sampling and Analysis:
 - 1. Collect and analyze Samples in accordance with AWWA standard.
 - 2. Sampling Frequency and Sampling Locations shall be agreed with Owner.
 - 3. Owner's laboratory shall be used for chlorine residual measurements.
- D. After piping assembly has been cleaned, disinfected, and refilled with potable water, Owner will take water Samples and have them analyzed for conformance to bacterial limitations for public drinking water supplies.
- E. Turbidity Sampling and Analysis: not used.
- F. Minimum Samples required above are bacterially positive, disinfecting procedures and bacteriological testing shall be repeated until bacterial limits are met.

END OF SECTION

SECTION 40 27 00
PROCESS PIPING—GENERAL

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section and any supplemental Data Sheets:
1. Air Force: A-A-58092, Tape Antiseize, Polytetrafluorethylene.
 2. American Society of Mechanical Engineers (ASME):
 - a. Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels.
 - b. Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
 - c. B1.20.1, Pipe Threads, General Purpose (Inch).
 - d. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
 - e. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
 - f. B16.9, Factory-Made Wrought Buttwelding Fittings.
 - g. B16.11, Forged Fittings, Socket-Welding and Threaded.
 - h. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
 - i. B16.25, Butt Welding Ends.
 - j. B31.3, Process Piping.
 - k. B36.19M, Stainless Steel Pipe.
 3. American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
 4. American Water Works Association (AWWA):
 - a. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
 - b. C606, Grooved and Shouldered Joints.
 5. American Welding Society (AWS):
 - a. Brazing Handbook.
 - b. A5.8/A5.8M, Specification for Filler Metals for Brazing and Braze Welding.
 - c. QC1, Standard for AWS Certification of Welding Inspectors.
 6. ASTM International (ASTM):
 - a. A135/A135M, Standard Specification for Electric-Resistance-Welded Steel Pipe.
 - b. A139/A139M, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).

- c. AA182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - d. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
 - e. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - f. B32, Standard Specification for Solder Metal.
 - g. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - h. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - i. D2464, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - j. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - k. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - l. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - m. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 - n. F436, Standard Specification for Hardened Steel Washers.
 - o. F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - p. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - q. F441/F441M, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 - r. F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
 - s. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - t. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
7. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-43, Wrought Stainless Steel Butt-Welding Fittings.
 8. NSF International (NSF): 61 Drinking Water System Components-Health Effects.

1.02 DESIGN REQUIREMENTS

- A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:
1. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.
 2. Building Service Piping: ASME B31.9, as applicable.
 3. Sanitary Building Drainage and Vent Systems: ICC International Plumbing Code.
 4. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.
 5. Thrust Restraints:
 - a. Design for test pressure shown in Piping Schedule.
 - b. Allowable Soil Pressure: 1,000 pounds per square foot.
 - c. Low Pressure Pipelines:
 - 1) When bearing surface of the fitting against soil provides an area equal to or greater than area required for thrust restraint, concrete thrust blocks will not be required.
 - 2) Determine bearing area for fittings without thrust blocks by projected area of 70 percent of internal diameter multiplied by chord length for fitting centerline curve.

1.03 SUBMITTALS

- A. Informational Submittals:
1. Manufacturer's Certification of Compliance:
 - a. Pipe and fittings.
 - b. Welding electrodes and filler materials.
 - c. Factory applied resins and coatings.
 2. Qualifications:
 - a. Weld Inspection and Testing Agency: Certification and qualifications.
 - b. Welding Inspector: Certification and qualifications.
 - c. Welders:
 - 1) List of qualified welders and welding operators.
 - 2) Current test records for qualified welder(s) and weld type(s) for factory and field welding.
 3. Weld Procedures: Records in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s).
 4. Nondestructive inspection and testing procedures.
 5. Test logs.
 6. Pipe coating applicator certification.

7. Laboratory Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.
8. Certified welding inspection and test results.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Independent Inspection and Testing Agency:
 - a. Ten years' experience in field of welding and welded pipe and fittings' testing required for this Project.
 - b. Calibrated instruments and equipment, and documented standard procedures for performing specified testing.
 - c. Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.
 - d. Testing Personnel: Qualified for nondestructive test methods to be performed.
 - e. Inspection Services: Qualified welding inspector.
2. Welding Inspector: AWS certified, AWS QC1 qualified, with prior inspection experience of welds specified.
3. Welder and Welding Operator Qualifications:
 - a. Qualified by accepted inspection and testing agency before starting Work in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code.
 - b. Qualified to perform groove welds in Positions 2G and 5G for each welding process and pipe material specified.
 - c. Qualification tests may be waived by Engineer based on evidence of prior qualification.
 - d. Retesting: Upon Engineer's written request, retest qualified welder(s).

B. Quality Control: Provide services of independent inspection and testing agency for welding operations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 00, Common Product Requirements, and:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent damage or excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

6. No forks allowed inside pipe or fittings.
7. All factory-installed thread on flanges on ductile iron pipe shall be sealed with a suitable sealant to prevent rusting.

PART 2 PRODUCTS

2.01 PIPING

- A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as Supplement.
- B. Diameters Shown:
 1. Standardized Products: Nominal size.
 2. Fabricated Steel Piping: Outside diameter, ASME B36.10M.

2.02 JOINTS

- A. Flanged Joints:
 1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced cast or ductile iron flanges.
 2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.
- B. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

2.03 GASKET LUBRICANT

- A. Lubricant shall be supplied by pipe manufacturer and no substitute or “or-equal” will be allowed.

2.04 FABRICATION

- A. Mark each pipe length on outside with the following:
 1. Size or diameter and class.
 2. Manufacturer’s identification and pipe serial number.
 3. Location number on laying drawing.
 4. Date of manufacture.
- B. Code markings according to approved Shop Drawings.
- C. Flanged pipe shall be fabricated in the shop, not in the field, and delivered to the Site with flanges in place and properly faced. Threaded flanges shall be

individually fitted and machine tightened on matching threaded pipe by the manufacturer.

2.05 FINISHES

- A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.
- B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.
- C. Welding Electrodes: Verify proper grade and type, free of moisture and dampness, and coating is undamaged.

3.02 PREPARATION

- A. See Piping Schedule and Section 09 90 00, Painting and Coating, for additional requirements.
- B. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.
- C. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.
- D. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's instructions.

3.03 WELDING

- A. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping.
- B. Weld Identification: Mark each weld with symbol identifying welder.
- C. Pipe End Preparation:
 - 1. Machine Shaping: Required.

2. All field-cut welded pipe ends shall be compliant with the joint geometry required by the approved welding procedure. Hand cut ends are not allowed for welded pipe.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
3. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
2. Root Opening of Joint: As stated in qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:

1. Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 32 degrees F.
2. Stainless Steel and Alloy Piping: If the ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required.

G. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting soundness of weld.

I. Weld Passes: As required in welding procedure.

J. Weld Quality: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in applicable piping code.

3.04 INSTALLATION—GENERAL

- A. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.
- B. Remove foreign objects prior to assembly and installation.
- C. Flanged Joints:
 - 1. Install perpendicular to pipe centerline.
 - 2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
 - 3. Use torque-limiting wrenches and sequenced bolt tightening pattern as required by the joint manufacturer to ensure uniform bearing and proper bolt tightness.
 - 4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange. Tightened flanged joints shall not produce bending or distortion of the flanges.
 - 5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
 - 6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast iron flange.
 - 7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
 - 8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
 - 9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
 - 10. Manufacturer: Same as pipe manufacturer or grooved joint flange adapter manufacturer.
- D. Threaded and Coupled Joints:
 - 1. Conform to ASME B1.20.1.
 - 2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
 - 3. Countersink pipe ends, ream and clean chips and burrs after threading.
 - 4. Make connections with not more than three threads exposed.
 - 5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.
- E. PVC and CPVC Piping:
 - 1. Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.

2. Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
3. Do not thread Schedule 40 pipe.

3.05 INSTALLATION—EXPOSED PIPING

A. Piping Runs:

1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 15, Piping Support Systems.

C. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

D. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

F. Piping clearance, unless otherwise shown:

1. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
3. From Adjacent Work: Minimum 2 inches from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
4. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
5. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.

7. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.06 BRANCH CONNECTIONS

- A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.
- B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including the first block valve in the line carrying the lower pressure, unless otherwise shown.
- C. Threaded Pipe Tap Connections:
 1. Ductile Iron Piping: Connect only with service saddle or at a tapping boss of a fitting, valve body, or equipment casting.
 2. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.

3.07 DISINFECTION

- A. See Section 33 13 00, Disinfection of Water Facilities.

3.08 FIELD FINISHING

- A. Notify Engineer at least 3 days prior to start of any surface preparation or coating application work.
- B. As specified in Section 09 90 00, Painting and Coating.

3.09 FIELD QUALITY CONTROL

- A. Pressure Leakage Testing: As specified in Section 40 80 01, Process Piping Leakage Testing.
- B. Minimum Duties of Welding Inspector:
 1. Job material verification and storage.
 2. Qualification of welders.
 3. Certify conformance with approved welding procedures.
 4. Maintenance of records and preparation of reports in a timely manner.
 5. Notification to Engineer of unsatisfactory weld performance within 24 hours of weld test failure.
- C. Required Weld Examinations:

1. Perform examinations in accordance with Piping Code ASME B31.3.
2. Perform examinations for every pipe thickness and for each welding procedure, progressively, for all piping covered by this section.
3. Examine at least one of each type and position of weld made by each welder or welding operator.
4. For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

3.10 CLEANING

- A. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines (except as stated below) with water at 2.5 fps minimum flushing velocity until foreign matter is removed.
- B. Blow clean of loose debris instrument air-lines with compressed air at 4,000 fpm; do not flush with water.
- C. If impractical to flush large diameter pipe at 2.5 fps or blow at 4,000 fpm velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.
- D. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.
- E. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.11 SUPPLEMENTS

- A. The supplements listed below, following “End of Section,” are a part of this Specification:
 1. Piping Schedule Legend.
 2. Piping Schedule.
 3. Facility Piping Color Identification Chart.
 4. Data Sheets.

Number	Title
40 27 00.08	Stainless Steel Pipe and Fittings—General Service
40 27 00.10	Polyvinyl Chloride (PVC) Pipe and Fittings

END OF SECTION

**SECTION 40 27 00.08
STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE**

Item	Size	Description
Pipe – Low Pressure Water Service (downstream of second stage)	2-1/2" & smaller	Schedule 10S: ASTM A312/A312M, Type 316 seamless, pickled and passivated.
	3" & larger	Schedule 40S: ASTM A312/A312M, Type 316L "as-welded" grade, pickled and passivated ASTM A312/A312M, Type 316L "as-welded" grade, pickled and passivated.
Pipe – High Pressure Water Service, (Between the discharge flanges of the NF feed pumps and the first stage)	2-1/2" & smaller	Schedule 10S: ASTM A312/A312M, Type 316L seamless, pickled and passivated.
	3" & larger	Schedule 40S: ASTM A312/A312M, Type 316L "as-welded" grade, pickled and passivated.
Tubing	All	ASTM A269, Type 316 stainless steel, seamless, fully annealed hydraulic tubing, 0.065-inch wall thickness minimum.
Joints	1-1/2" & smaller	Threaded or flanged at equipment as required or shown.
	2" & larger	Butt-welded or flanged at valves and equipment.
Tubing Joints	All	Flareless compression fitting.
Fittings	1-1/2" & smaller	Threaded: Forged 1,000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150 or Class 300, ASTM A351/A351M, Grade CF8M/316.
	2" & larger	Butt Welded: ASTM A403/A403M, Grade P316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
Tubing Fittings	All	Flareless Compression Type Forged: ASTM A182/A182M, Grade F316, Parker-Hannifin Ferulok, Flodar BA Series.
Branch Connections	1-1/2" & smaller	Tee or reducing tee in conformance with fittings above.
	2" & larger	Butt-welding tee or reducing tee in accordance with fittings above.
Tubing Branch Connections	All	Compression type tees or reducing tees in accordance with Tubing Fittings above.

**SECTION 40 27 00.08
STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE**

Item	Size	Description
Flanges	All	<p>Forged Stainless Steel: ASTM A182/A182M, Grade F316L, ASME B16.5 Class 150 or Class 300, slip-on weld neck or raised face. Weld slip-on flanges inside and outside.</p> <p>Blind Flanges, exposed to the atmosphere and not buried nor immersed in liquid, may be stainless steel.</p>
Unions	2" & smaller	<p>Threaded Forged: ASTM A182/A182M, Grade F316, 2,000-pound or 3,000-pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.</p>
Bolting	All	<p>Forged Flanges: Type 316 stainless steel, ASTM A320/A320M Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.</p> <p>Van Stone Flanges and anywhere mating flange on equipment is cast iron and gasket is flat ring: Carbon steel ASTM A307 Grade B hex head bolts, ASTM A563 Grade A hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.</p> <p>Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.</p>
Gaskets	All Flanges	<p>Flanged, Water, Hot Air, Fuel Gas and Sewage Services: 1/8-inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F. continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade.</p> <p>Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.</p>

**SECTION 40 27 00.08
STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE**

Item	Size	Description
Thread Lubricant	2" & smaller	General Service: 100 percent virgin PTFE Teflon tape.
All stainless steel pipes, fittings and other components shall be free of carbon contamination and heat discoloration resulting from welding. All welded stainless steel pipes, fitting and other components shall be pickled and passivated.		

END OF SECTION

**SECTION 40 27 00.10
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS**

Item	Size	Description
General	All	Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded Nipples: Schedule 80 PVC.
Fittings	All	Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.

**SECTION 40 27 00.10
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS**

Item	Size	Description
Flanges	All	One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling

**SECTION 40 27 00.10
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS**

Item	Size	Description
Bolting	All	<p>Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.</p> <p>With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.</p>
Gaskets	All	<p>Flat Face Mating Flange: Full faced 1/8-inch-thick Durlon, 9200W RCA, Garlock Gylon 3510 for sodium hypochlorite service and ethylene propylene (EPR) rubber for all other services.</p> <p>Raised Face Mating Flange: Flat ring 1/8-inch Durlon, 9200W RCA, Garlock Gylon 3510 for sodium hypochlorite service and ethylene propylene (EPR) rubber for all other services, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.</p>

**SECTION 40 27 00.10
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS**

Item	Size	Description
Solvent Cement	All	Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656 and as recommended by pipe and fitting manufacturer, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.
Thread Lubricant	All	Teflon Tape.

END OF SECTION

SECTION 40 27 01
PROCESS PIPING SPECIALTIES

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
 - b. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
 - 2. American Water Works Association (AWWA):
 - a. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
 - b. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
 - c. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
 - d. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 - e. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
 - f. Manual M11, Steel Pipe—A Guide for Design and Installation.
 - 3. ASTM International (ASTM):
 - a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - 4. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - 5. NSF International (NSF):
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
 - b. NSF/ANSI 372, Drinking Water System Components - Lead Content.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, and live lengths (as applicable).
- B. Informational Submittals:
 - 1. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide required piping specialty items, whether shown or not shown on Drawings, as required by applicable codes and standard industry practice.

- B. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
1. Use or reuse of components and materials without a traceable certification is prohibited.

2.2 CONNECTORS

- A. Quick Connect Couplings for Chemical Services:
1. Type: Twin cam arm actuated, male and female, locking, for chemical loading and transfer.
 2. Materials: Glass-filled polypropylene or PVDF with EPDM, Viton-A or Teflon gaskets as recommended for the service by manufacturer.
 3. End Connections: NPT threaded or flanged to match piping connections. Hose shank for chemical installations.
 4. Plugs and Caps: Female dust cap for each male end; male dust plug for each female end.
 5. Pressure Rating: 125 psi, minimum, at 70 degrees F.
 6. Manufacturers and Products:
 - a. OPW; Kamlock.
 - b. Ryan Herco; 1300 Series.

END OF SECTION

SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
 - a. B16.5 Stainless Steel Pipe Flanges and Flanged Fittings.
2. American Water Works Association (AWWA):
 - a. C540, Power Actuating Devices for Valves and Sluice Gates.
 - b. C606, Grooved and Shouldered Joints.
3. ASTM International (ASTM):
 - a. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
 - b. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
 - c. D429, Test Methods for Rubber Property—Adhesion to Rigid Substrates.
 - d. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
4. Manufacturers Standardization Society (MSS):
 - a. SP 110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
5. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
6. NSF International (NSF):
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
 - b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
7. Underwriters Laboratories (UL).

1.02 SUBMITTALS

A. Shop Drawings:

1. Product data sheets for make and model.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Power and control wiring diagrams, including terminals and numbers.
4. Certification of NSF 61 compliance.

- B. Information Submittals:
 - 1. Tests and inspection data.
 - 2. Manufacturer's Certificate of Proper Installation.
 - 3. Operation and Maintenance Manual.

PART 2 PRODUCTS

2.01 GENERAL

- A. The specifications of this section indicate the minimum requirements for the Vendor. It is the responsibility of the Vendor to ensure that all valves and operators are suitable for the intended service and compatible with the proposed process systems.
- B. All internal components of valves that come in contact with water shall be manufactured using NSF 61 approved.
- C. Valve ends to suit adjacent piping.
- D. Size operator to operate valve for the full range of pressures and velocities.
- E. Valve to open by turning counter-clockwise.
- F. Field mount actuator and accessories.
- G. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
- H. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 VALVES

- A. Ball Valves:
 - 1. Type V306 Stainless Steel Ball Valve 2 Inches and Smaller:
 - a. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever

operator with vinyl grip, rated 1,000 psig CWP, complies with MSS SP 110.

- b. Manufacturers and Products:
 - 1) Conbraco Apollo; 76F-100 Series.
 - 2) Nibco; T-585-S6-R-66-LL.

2. Type V330 PVC Ball Valve 2 Inches and Smaller:

- a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O ring stem seals, to block flow in both directions. [Provide pressure relief hole drilled on low pressure side of ball.]
- b. Manufacturers and Products:
 - 1) Nibco; Chemtrol Tru-Bloc.
 - 2) ASAHI/America; Type 21.
 - 3) ASAHI/America; Type 57.
 - 4) Spears, Tru union

B. Butterfly Valves:

1. Type V520 Solid PVC Butterfly Valve 1-1/2 Inches to 14 Inches:

- a. ANSI Class 150 lug style
- b. Rated 150 psi at 70 degrees F CWP, solid ASTM D1784, Type 1, Grade 1, PVC body and contoured PVC or polypropylene valve disc, Type 316 SST valve stem, Viton seat, lever or gear operator.
- c. Manufacturers and Products:
 - 1) ASAHI/America; Type 57IL.
 - 2) Spears.

C. Check Valve:

1. Type V630 PVC Ball Check Valve 4 Inches and Smaller:

- a. ASTM D1784, Type I, Grade 1 polyvinyl chloride body, dual union socket weld ends, rated 150 psi at 73 degrees F, and Viton seat and seal.
- b. Manufacturers and Products:
 - 1) Nibco; Chemtrol Tru Union.
 - 2) ASAHI/America.
 - 3) Spears; True Union.

2.03 OPERATORS

A. Manual Operator:

1. General:

- a. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
- b. Operator self-locking type or equipped with self-locking device.
- c. Position indicator on quarter turn valves.
- d. Worm and gear operators one-piece design worm gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threader steel reach rods with internally threaded bronze or ductile iron nut.

B. Electric Motor Actuators, 120 Volts:

- 1. General:
 - a. Comply with latest version of AWWA C542.
 - b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
 - c. Controls integral with actuator and fully equipped as specified in AWWA C542.
 - d. Stem protection for rising stem valves.
- 2. Actuator Operation—General:
 - a. Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves, as applicable.
 - b. Manual override handwheel.
 - c. Valve position indication.
 - d. Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in Electric Actuated Valve Schedule.
- 3. Modulating (M) Service:
 - a. Size actuators for continuous modulating duty.
 - b. Feedback potentiometer, or equivalent, and integral electronic positioner/comparator circuit to maintain valve position.
 - c. HAND-OFF-AUTO (Local-Off-Remote) Selector Switch, padlockable in each position:
 - 1) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in HAND (Local) position.
 - 2) 4 mA to 20 mA dc input signal to control valve in AUTO (Remote) position.
 - 3) Auxiliary contact that closes in AUTO (Remote) position.
 - d. OPEN and CLOSED indicating lights.
 - e. AC motor with solid state reversing starter or DC motor with solid state reversing controller, and built-in overload protection. Controller capable of 1,200 starts per hour.
 - f. Duty cycle limit timer and adjustable band width, or equivalent, to prevent actuator hunting.

- g. Valve position output converter that generates isolated 4 mA to 20 mA DC signal in proportion to valve position and is capable of driving into loads of up to 500 ohms at 24 volts DC.
- 4. Limit Switch:
 - a. Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120 volts ac.
 - b. Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
 - c. Housed in actuator control enclosure.
- 5. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule.
- 6. Manufacturers and Products:
 - a. Rotork Controls; IQ.
 - b. Flowserve Limitorque; QX-2.

2.04 ACCESSORIES

- A. Tagging: 1-1/2-inch diameter stainless steel tag attached with No. 16 stainless steel jack chain for each valve operator.
- B. Position/Limit Switch:
 - 1. Factory installed position/limit switch by valve manufacturer.
 - 2. SPST, rated at 5 amps, 120V ac.
 - 3. Manufacturers:
 - a. Asco.
 - b. Westlock.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Flange Ends:
 - 1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
 - 2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.
- B. PVC and CPVC Valves: Install using solvents approved for valve service conditions.
- C. Valve Installation and Orientation:
 - 1. General:
 - a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
 - b. Install valves in location for easy access for routine operation and maintenance.

- c. Install valves per manufacturer's recommendations.
- 2. Ball Valves:
 - a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
 - b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
- 3. Check Valves:
 - a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.

END OF SECTION

SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Chlorine Institute (2001 L Street N.W., Washington D.C. 28036):
Pamphlet 6, Piping Systems for Dry Chlorine.

1.02 SUBMITTALS

- A. Informational Submittals:
1. Testing Plan: Submit prior to testing and include at least the information that follows.
 - a. Testing dates.
 - b. Piping systems and section(s) to be tested.
 - c. Test type.
 - d. Method of isolation.
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested.
 2. Certifications of Calibration: Testing equipment.
 3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

- A. Notify Engineer in writing 5 days in advance of testing. Perform testing in presence of Engineer.
- B. Pressure Piping:
1. Install temporary restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
 2. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
 3. New Piping Connected to Existing Piping:
 - a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.

- b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer.
 - 4. Items that do not require testing include: Equipment seal drains, tank overflows to atmospheric vented drains, and tank atmospheric vents.
 - 5. Test Pressure: 1.5 times working pressure to be confirmed with Engineer
- C. Test section may be filled with water and allowed to stand under low pressure prior to testing.
- D. Gravity Piping:
 - 1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
 - 2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to Engineer.
 - 3. Pipe 42 Inches Diameter and Larger: Joint testing device may be used to isolate and test individual joints.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

- A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.
- B. Exposed Piping:
 - 1. Perform testing on installed piping prior to application of insulation.
 - 2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
 - 3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
 - 4. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
 - 5. Examine joints and connections for leakage.
 - 6. Correct visible leakage and retest as specified.
 - 7. Empty pipe of water prior to final cleaning or disinfection.

3.03 HYDROSTATIC TEST FOR GRAVITY PIPING

- A. Testing Equipment Accuracy: Plus or minus 1/2 gallon water leakage under specified conditions.

- B. Maximum Allowable Leakage: 0.16 gallons per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.
- C. Exfiltration Test:
 - 1. Hydrostatic Head:
 - a. At least 6 feet above maximum estimated groundwater level in section being tested.
 - b. No less than 6 feet above inside top of highest section of pipe in test section, including service connections.
 - 2. Length of Pipe Tested: Limit length such that pressure on invert of lower end of section does not exceed 30 feet of water column.
- D. Infiltration Test:
 - 1. Groundwater Level: At least 6 feet above inside top of highest section of pipe in test section, including service connections.
- E. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.
- F. Defective Piping Sections: Replace and retest as specified.

3.04 FIELD QUALITY CONTROL

- A. Test Report Documentation:
 - 1. Test date.
 - 2. Description and identification of piping tested.
 - 3. Test fluid.
 - 4. Test pressure.
 - 5. Remarks, including:
 - a. Leaks (type, location).
 - b. Repair/replacement performed to remedy excessive leakage.
 - 6. Signed by Contractor and Engineer to represent that test has been satisfactorily completed.

END OF SECTION

SECTION 40 90 01 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

Common Abbreviations Applicable to This Document

CP – Control Panel

FCV – Flow Control Valve

FIT – Flow Indicator and Transmitter

FOPP – Fiber Optic Patch Panel

GPM – Gallons per Minute

HMI – Human Machine Interface

I/O – Input/Output

MG – Million Gallons

NEMA – National Electrical Manufacturers Association

NFPA – National Fire Protection Association

OIT – Operator Interface Terminal

PICS – Plant Instrumentation and Control System

PLC – Programmable Logic Controller

PTFE – Polytetrafluorethylene

SCADA – Supervisory Control and Data Acquisition

SCCR – Short-Circuit Current Rating

SFP – Small Form-Factor Pluggable

UL – Underwriter Laboratories

VAC – Voltage, Alternating Current

VDC – Voltage, Direct Current

Summary

The following section specifies the minimum requirements for selection, installation, and testing of the instrumentation and controls related to the degasifier upgrades in this project. The major items in the scope of work includes:

- Provide four new magnetic flowmeters on the degasifier feed lines
- Provide a new valve control panel with a PLC and OIT for operating four new modulating actuators and for monitoring of the flow control valve positions and degasifier inlet flow readings
- Integrate the new valve control panel with the facility Ethernet network for remote monitoring of the valve positions and flow readings.

New Magnetic Flowmeters: 13-FIT-01, 13-FIT-02, 13-FIT-03, 13-FIT-04

1. Refer to Component Specification F4 at the end of this document for detailed requirements on the selected magnetic flow sensor and transmitter.
2. Install magnetic flow sensor and transmitter per manufacturer's instructions. At a minimum, installation shall adhere to the following requirements:
 - a. Install flow element with at least 5-diameters (5D) of straight pipe upstream and 2-diameters (2D) downstream without interfering with fittings, tees, or elbows.
 - b. Install flow element in a vertical configuration facing up per manufacturer's instructions.
 - c. Install proper grounding per manufacturer's instructions.
 - d. Brace signal wire and conduits to prevent swaying or shaking lines during operation.
3. Each transmitter shall be installed inside the new control panel 13-CP-01. Transmitter face shall be accessible from the internal panel door through a panel cutout. Route cabling and conduit between flow element and transmitter through panel enclosure.

New Control Panel: 13-CP-01

1. Refer to Drawing E-105 and the Electrical Notes and Material Performance Specifications for minimum requirements on the new control panel.
2. In addition to the requirements referenced above, the control panel installation shall also adhere to the following requirements:
 - a. Provide an Allen-Bradley CompactLogix PLC system (tagged 13-PLC-01) to interface hardwired signals from the new valve actuators, as well as EtherNet/IP communications with the degasifier flow transmitters. Additionally, provide a fiber optic link between the new control panel and the existing PLC network. Program modifications to existing SCADA system to monitor PLC tags.
 - b. Provide an Allen-Bradley PanelView Operator Interface Terminal (OIT) mounted on the internal panel door to allow operators to monitor the positions of the control valves, flowmeter readings, and remote control capability of the valve actuators.
 - i. All OIT command fields shall be password protected. User must login to allow controls.

- ii. At a minimum, provide an overview screen of the degasifier process showing the current valve status and flowmeter readings for all four degasifier towers. Provide navigation buttons to access the flow control valve commands as a faceplate or similar screen.
 - iii. Provide navigation buttons on each screen for “Forward”, “Back”, and “Return to Overview” to conveniently cycle between OIT screens. Allow operators to reach any screen within three button presses or less.
 - iv. Active alarms shall be shown on both the screen graphic and an alarm stack. Provide the alarm stack on the top or bottom of each page showing active alarms. Allow operators to acknowledge alarms on the stack.
 - v. All OIT screen graphics and color coding shall conform to current Collier County SCADA System standards.
- c. Provide a DIN rail mounted, uninterruptible power supply (UPS) inside the panel to maintain power to displays, PLC rack power supplies, flowmeters, and all other control circuits. Provide input to SCADA system if the system switches to UPS supply in the event of a loss of primary power inside the panel.
- d. Size control panel for adequate heat dissipation and to house all equipment, wireways, and operator interfaces. Perform heat calculation prior to purchasing of equipment.
- e. Perform a power budget calculation on all equipment powered by control panel power supplies to determine the correct quantity and sizing of power supplies. Perform calculations prior to purchasing of equipment and installation of panel components.
- f. Panel shall be fully constructed in accordance with UL 508A, Standard for Industrial Control Panels. All internal panel components are to be UL Listed. Apply clearly visible UL 508A label and SCCR label to panel.
- g. Provide document holder inside interior door of enclosure and include panel layout and electrical wiring diagrams inside.
- h. Provide surge suppression for incoming 120VAC power into the control panel, in addition to analog and digital surge suppression for the hardwired interface between the valve actuators and the control panel. Surge suppressors shall be UL Listed.
 - i. Manufacturers:
 - 1. EDCO
 - 2. Citec.
 - 3. Or equal.
- i. Provide a panel light and desiccant module inside the control panel enclosure.
- j. Install door switch inside panel that is in series with the light switch inside the panel. Additionally, provide an intrusion alarm signal to the PLC station that triggers when the door is opened.
- k. Duct seal conduit penetrations into enclosure after completion.
- l. Refer to Supplement 1, Component Specifications at the end of this document for detailed requirements on instrumentation and control panel devices.

List of I/O Points to be interfaced with 13-PLC-01

Equipment Tag	Signal Description	Signal Type
13-FCV-01	Degasifier # 1 Flow Control Valve In Remote	Digital Input
13-FCV-01	Degasifier # 1 Flow Control Valve Position Feedback	Analog Input
13-FCV-01	Degasifier # 1 Flow Control Valve Position Command Signal	Analog Output
13-FCV-02	Degasifier # 2 Flow Control Valve In Remote	Digital Input
13-FCV-02	Degasifier # 2 Flow Control Valve Position Feedback	Analog Input
13-FCV-02	Degasifier # 2 Flow Control Valve Position Command Signal	Analog Output
13-FCV-03	Degasifier # 3 Flow Control Valve In Remote	Digital Input
13-FCV-03	Degasifier # 3 Flow Control Valve Position Feedback	Analog Input
13-FCV-03	Degasifier # 3 Flow Control Valve Position Command Signal	Analog Output
13-FCV-04	Degasifier # 4 Flow Control Valve In Remote	Digital Input
13-FCV-04	Degasifier # 4 Flow Control Valve Position Feedback	Analog Input
13-FCV-04	Degasifier # 4 Flow Control Valve Position Command Signal	Analog Output
13-CP-01	Panel Loss of Utility Power	Digital Input
13-CP-01	Panel Intrusion Alarm	Digital Input

Total I/O Counts: 6 Digital Inputs, 4 Analog Inputs, 4 Analog Outputs

Control Narrative Summary for Degasifier Flow Control Valves and Flowmeters

1. Each flow control valve shall have two operating modes: Local and Remote Manual.
2. In Local mode, the Local/Remote switch at the valve actuator is placed in the Local position.
 - a. In Local mode, the operator adjusts the valve position using the positioner controls at the valve actuator itself.

- b. On the OIT at the new control panel and on the plant SCADA system HMIs, provide text to indicate the valve in Local mode and apply the standard color graphic for equipment in Local.
 - i. At the OIT, disable and gray out valve control buttons on the screen to clearly indicate the valve cannot be controlled from the OIT in Local mode.
 - ii. Valve position indication shall remain monitored at both the OIT and SCADA System HMIs regardless of Local/Remote status.
- 3. In Remote Manual mode, the Local/Remote switch at the valve actuator is placed in the Remote position.
 - a. In Remote Manual mode, the operator adjusts the valve position by entering a position setpoint on the HMI screen.
 - b. On the OIT at the new control panel and on the plant SCADA system HMIs, provide text to indicate the valve in Remote mode and apply the standard color graphic for equipment in Remote.
 - i. At the OIT, enable valve control buttons on the screen. Adjustments of the valve position shall not be available without a user login.
 - ii. Include a position discrepancy alarm that alerts the operator if the valve position feedback does not correspond to the valve position command after a time delay.
 - 1. Both the time delay and percent discrepancy setpoints shall be operator-adjustable.
 - 2. Adjustments of the time delay and percent discrepancy values shall not be available without a user login.
- 4. For each degasifier flowmeter, provide the following functionality, at minimum:
 - a. Each degasifier flow transmitter shall communicate with the PLC and OIT via EtherNet/IP network communications. PLC shall read the following values from each transmitter:
 - i. Flow reading in appropriate engineering units (gpm)
 - ii. Flow totalizer value
 - iii. Flow totalizer reset from PLC
 - iv. Empty pipe detection alarm
 - b. Program a loss of communications alarm if the Ethernet signal is disconnected for 30 seconds or more. Provide an alarm on the OIT and existing plant SCADA System HMI until communications are restored.
 - c. Program alarm setpoints for High and Low flow alarms.
 - i. For each alarm setpoint, provide an operator-adjustable time delay and deadband value. All alarm setpoints shall be entered only at the OIT on the new control panel.
 - ii. Provide buttons to Enable/Disable alarms for each flowmeter on the OIT. Enabling and disabling alarms shall require a login.

- iii. Once an alarm is triggered, indicate the alarm on both the new control panel OIT and the plant SCADA system HMI. Allow the alarm to be acknowledged from either location.
- d. Provide alarms for empty pipe detection relayed from the flow transmitter.
- e. Provide totalization of flow for each flowmeter. Display the totalized value at both the OIT screen and SCADA System HMI. Flow units shall match the Owner's standard. If a standard is not available, then display units in MG.
 - i. Resetting the totalizer shall be available at both the transmitter and the new OIT. Login is required to enable reset of the totalizer. Provide a timestamp of each time the reset is initiated from the OIT.
 - ii. In addition to the current totalizer value, program totals for Today's Flow and Yesterday's Flow.

Integration of Degasifier Upgrades with Existing SCADA System

1. In addition to interfacing the new PLC with the new OIT, the existing SCADA System shall be modified to establish communications between the new PLC and the existing SCADA System on the same network. The network connection shall be used to allow monitoring and trending of the degasifier tag values by the existing SCADA System. However, no controls shall be permitted by the existing SCADA System PLCs or HMIs.
2. All integration tasks with the existing facility SCADA system shall adhere to the Collier County standards listed in Supplement 2. In the event of a conflict between the contents of this document and the supplement, then the supplement shall take precedent.
3. Route multimode fiber from the fiber optic patch panel in 13-CP-01 through the PLC-3 cabinet and into the main facility. Determine an appropriate existing PLC control panel to terminate fiber. Terminate fiber at the panel's FOPP and route a patch cable to an existing Cisco Stratix 8000 switch. Provide and install an SFP module at the existing switch to complete the connection.
 - a. Prior to ordering fiber, Contractor shall coordinate with Owner on determining the network tie-in point in the existing facility to finalize fiber cable length.
4. Program modifications to the existing SCADA system HMI to monitor the following tags from the new 13-PLC-01:
 - a. Display the degasifier inlet valve status and positions on the current degasifier HMI graphic screen.
 - b. Display the degasifier inlet flow values on the current degasifier HMI graphic screen.
 - c. Provide HMI alarm for loss of communications between the plant SCADA network and the 13-PLC-01.
 - d. Provide HMI alarm for loss of communications between the plant SCADA network and each of the flowmeters.
 - e. Provide HMI alarm for panel intrusion at 13-CP-01 when the panel door is opened.

- f. Provide HMI alarm for loss of power alarm at 13-CP-01 if the panel switches to UPS supply in the event of primary power loss.
- g. Provide HMI alarms for low and high flow alarms.
- h. Provide trending for all floating point values from 13-PLC-01.

Test Procedures

1. Prior to installation in the field, perform an unwitnessed Factory Acceptance Test on 13-CP-01.
 - a. Test digital inputs into the PLC I/O modules by jumping connection points one at a time with an energized source and check the LED and I/O table reading corresponding to each point. Include testing of spare inputs into the PLC I/O module. Document pass/fail status of each I/O point.
 - b. Test analog inputs into the PLC I/O modules by connecting a multimeter to the field-side circuit and modulating current output. Simulate minimum and maximum limits on the 4-20mA analog scale, as well as multiple readings within the scale range. At a minimum, test each analog signal at 4mA, 8mA, 12mA, 16mA, and 20mA. Record the corresponding analog raw count or scaled engineering unit monitored at the PLC. Include testing of spare inputs into the PLC I/O module. Document pass/fail status of each I/O point.
 - c. Test analog outputs from the PLC by forcing outputs at the controller watch table. Simulate minimum and maximum limits on the 4-20mA analog scale, as well as multiple readings within the scale range. At a minimum, test each analog signal at 4mA, 8mA, 12mA, 16mA, and 20mA. Record the corresponding current reading using a multimeter connected to the field-side of the analog circuit. Include testing of spare outputs from the PLC I/O module. Document pass/fail status of each I/O point.
 - d. All test documents shall be signed and submitted to Owner and Engineer after successful completion of the test.
2. After installation in the field, perform a witnessed Operational Readiness Test on 13-CP-01. Establish connection between the new PLC and existing SCADA System network and monitor inputs and outputs in response to changes from field devices.
 - a. Test digital inputs by actively toggling field equipment. Examples include:
 - i. Turn the selector switches on the FCV actuators to check for Remote status signal at the PLC.
 - ii. Open the 13-CP-01 panel door to check for a panel intrusion alarm.
 - iii. Switch off the power supply circuit breaker to simulate a loss of utility power.
 - b. Test analog inputs using the following methods:
 - i. Test valve position feedback by operating positioner on the valve actuators. Check the valve position on the OIT and the SCADA system HMI.

- c. Test analog outputs by issuing valve position commands from the SCADA system HMI. Observe the response of the control valve and check the valve position feedback.
- d. Document pass/fail for all field connected I/O. Spares are not required to be checked during this test.
- e. Test Ethernet communications between the new PLC and the degasifier flow transmitters.
 - i. Disconnect communications cable from each flowmeter to create a loss of communications alarm after 30 seconds.
 - ii. Reconnect the Ethernet cable and verify communications are restored.
 - iii. Verify the Ethernet signals required from the transmitter are actively read by the PLC.
 - iv. Verify that a reset from the PLC is registered by the flow transmitter.
 - v. Document pass/fail for communications check.
- f. Test Ethernet communications between the new PLC and the existing SCADA System.
 - i. Disconnect communications cable from the new PLC and verify a loss of communications alarm is triggered at the SCADA System HMI and OIT after 30 seconds.
 - ii. Reconnect communications cable and verify communications are restored.
 - iii. Verify that the existing SCADA system HMI is actively reading and displaying tag values from the new PLC.
 - iv. Document pass/fail for communications check.
- g. All test documents are to be signed by the system integrator in addition to the Owner and/or Owner's representative after successful completion of the test.

Supplements

The following supplements are included at the end of this document:

1. Component Specifications
2. Collier County SCADA Integration Standards

Supplement 1 - Component Specifications:

F4 Flow Element and Transmitter, Electromagnetic:

General:

Function: Measure, indicate, and transmit the flow of a conductive process liquid in a full pipe.

Type:

Electromagnetic flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.

Full bore meter with magnetic field traversing entire flow-tube cross section.

Unacceptable are insert magmeters or multiple single point probes inserted into a spool piece.

Parts: Flow element, transmitter, interconnecting cables, and mounting hardware. Other parts as noted.

Transmitter: Most electromagnetic flowmeters have remote transmitters. Prior to submittals, review mechanical Drawings to determine whether some transmitters are integral.

Service:

Stream Fluid:

Degasifier Feed Water.

Suitable for liquids with a minimum conductivity of 5 microS/cm and for demineralized water with a minimum conductivity of 20 microS/cm.

Operating Temperature:

Element:

Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.

Process: Minus 5 to 140 degrees F, typical, unless otherwise noted.

Transmitter:

Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.

Storage: 15 to 120 degrees F, typical, unless otherwise noted.

Performance:

Flow Range: 0 gpm to 4600 gpm.

Accuracy: Plus or minus 0.5 percent of rate for all flows resulting from pipe velocities of 2 to 30 feet per second.

Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.

Features:

Zero stability feature to eliminate the need to stop flow to check zero alignment.

No obstructions to flow.

Very low pressure loss.

Measures bi-directional flow.
Empty pipe detection.
Flow totalization and totalization reset features.

Process Connection:

Meter Size: As noted or shown.
Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D; or wafer style depending on meter size, unless otherwise noted.

Flange Material: Carbon steel, unless otherwise noted.

Power (Transmitter): 120V ac, 60-Hz, unless otherwise noted.

Element:

Meter Tube Material: Type 304 or 316 stainless steel, unless otherwise noted.

Liner Material:

PTFE, unless otherwise noted.

For potable water service, must have appropriate approvals.

Liner Protectors: Covers (or grounding rings) on each end to protect liner during shipment.

Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.

Electrode Material: Type 316 stainless steel or Hastelloy C, unless otherwise noted.

Grounding Ring:

Required, unless otherwise noted.

Quantity: Two, unless otherwise noted.

Material: Type 316 stainless steel, unless otherwise noted.

Enclosure: NEMA 4X, minimum, unless otherwise noted.

Transmitter:

Mounting:

Panel mounted, refer to Drawings for layout.

Display: Required, unless otherwise noted.

Digital LCD display, indicating flow rate and total.

Bi-directional Flow Display: Required, unless otherwise noted.

Forward and reverse flow rate.

Forward, reverse and net totalization.

Empty pipe detection alarm.

Parameter Adjustments: By keypad or non-intrusive means.

Enclosure: NEMA 4X, minimum, unless otherwise noted.

Minimum threshold velocity: 0.3 m/s, unless otherwise noted.

Empty Pipe Detection:

Drives display and outputs to zero when empty pipe detected.

Signal Interface (at Transmitter):

Communications: Ethernet port to support EtherNet/IP communications between transmitter and Allen-Bradley PLC and HMI network.

Cables:

Types: As recommended by manufacturer.

Lengths: As required to accommodate device locations and fluid conductivity limitations.

Built-in Diagnostic System:

Features:

Field programmable electronics.

Self-diagnostics with troubleshooting codes.

Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.

Initial flow tube calibration and subsequent calibration checks.

Factory Calibration:

Calibrated in an ISO 9001 and NIST certified factory.

Factory flow calibration system must be certified by volume or weight certified calibration devices.

Factory flow calibration system shall be able to maintain calibration flow rate for at least 5 minutes for repeatability point checks.

Factory Ready for Future In situ Verifications: If noted.

Original meter parameter values available from vendor by request.

Manufacturers:

Endress & Hauser, Inc. Flow Measuring System, Promag L 400

Y81 Industrial Network Managed Layer 2 Switch, Ethernet, DIN Rail:

General:

Full compliance with IEEE 802.3.

Supports Ethernet/Fast Ethernet 10/100BASE-TX and 100BASE-FX.

Layer 2 software.

Provide network switching for up to 10 Ethernet ports within a single chassis.

Network Topology: Ring or star.

Redundancy: Real-Time-Ring or Rapid Spanning Tree.

Management: Serial interface, web interface, SNMP v1, v2, with SNMPv3 for security.

Diagnostics:

LEDs (Power, Link Status, Data, Fault, redundancy manager, ring-port, LED test).

Log File.

RMON (statistics, history alarms, events).

Port mirroring.

Topology discover 802.1ab.

Configuration: Command Line Interface (CLI), TELNET, BootP, DHCP Option 82, HIDiscovery, Auto configuration adapter (ACA21-USB).

Security:

Port security (MAC based and IP based).

SNMP V3 authentication & encryption.

Other Services:

QoS 4 queues, port prioritization (IEEE 802.1D/p), VLAN (802.1Q).
Multicast (IGMP Snooping/Queier).
Broadcast limiter.
Flow Control (IEEE 802.3x SNTP).

Redundancy:

Real-Time-Ring or Rapid Spanning Tree. (ring structure).
RSTP.
Redundant net-/ring coupling.
Dual Homing.
Redundant 24-volt power supply.

Physical Characteristics:

DIN-rail mountable.
Operating Temperature: -10 degrees C to 60 degrees C.
Input Voltage: 24V dc.
Max Power Consumption: 15.7 W
Isolation: 75 V Continuous
Protection Class: IP 20.

SFP Ports:

Provide dual-LC SFP port and module for multimode fiber connection.
Provide SFP connection at both new switch and on existing switch for existing SCADA network tie-in.
Manufacturer and Product: Cisco; Model 1783-SFP-100FX

IEC 60068-2-27 Shock: 15 g, 11 ms duration, 18 shocks.

IEC 60068-2-6 Vibration:

1 mm, 2 to 13.2-Hz, 90 minutes.
0.7g, 13.2 to 100-Hz, 90 minutes.
3.5 mm, 3 to 9-Hz, 10 cycles, 1 octave/minute.
1g, 9 to 150-Hz, 10 cycles, 1 octave/minute.

Approvals: UL 508.

Manufacturer and Product:

Cisco; Stratix 8000
No Exceptions

Y99 Fiber Optic Patch Panel, DIN Rail Mounted

General:

Function: Used for termination of fiber optic cable inside control panel.

Physical:

Operating Temperature: Minus 40 degrees C to 70 degrees C.
IP 20 protection rating.

Features:

UL Listed.
Compatible with OM1/OM2 fiber optic cable.
Six LC-quad fiber connectors.

Manufacturers and Products:

DINSpace SNAP module.
L-Com.
Black Box.

Or equal.

Y169 Programmable Logic Controller System, Modular Unit:

General:

Function: Used for process monitoring and control by emulating functions of conventional panel mounted equipment such as relays, timers, counters, current switches, calculation modules, PID controllers, stepping switches, and drum programmers.

Type: Microprocessor based device programmable using ladder logic.

Parts: Central processing unit (CPU), power supply, local input/output modules, local base (rack) controllers, I/O bases (rack), and factory assembled interconnecting cables. Provide components required to make a complete and totally operational system. Reference PLC system block diagram in Drawings.

Environmental:

Temperature: Operating range 32 to 140 degrees F (0 to 60 degrees C); storage range minus 40 to 185 degrees F (minus 40 to 85 degrees C).

Humidity: Operating range 5 to 95 percent noncondensing.

Vibration:

Sinusoidal: IEC 68-2-6, Test Fc; 0.15 mm peak-to-peak, 2 g at 10 to 500 Hz.

Noise: IEC 801, Part 3, Level 3 and Part 4, Level 3; MIL STD-461B.

Isolation: User-side to PLC side 1,500V rms.

Central Processing Unit (CPU):

Type: Microprocessor, 16-bit minimum.

Scan Time: Less than 1 ms/K words of relay ladder logic.

Local Module Scan Time:

Digital and Analog: 1ms max for 4 modules, 2ms max for 5-30 modules.

Specialty: 1 to 2 ms per module.

PLC Communications:

Integrated EtherNet/IP port for SCADA communications.

Instruction Set:

Timers and Counters: Quantity 1024 minimum; minimum timer resolution 0.1 second; minimum counter count range 0 to 32,000.

Math: Signed integer and floating-point math including add, subtract, multiply, divide, square root, and compare.

Register Operations: Shift registers, bit shift, bit set, bit clear, data move and data format conversion.

Process Loop Control: User configurable direct or reverse acting PID loop control computation with the capability of both AUTO and MANUAL modes of operation, remote access to controller tuning constants; minimum of 64 PID loops.

Real Time Clock: Date and time set and compare.

Miscellaneous: Jump or skip to a label, quantity 255 one shot, quantity 1024 drums, quantity 64 preconfigured analog alarm functions, quantity 128 subroutines, quantity 128.

Diagnostics:

Indicators: Battery status, PLC status, and PLC operation mode.

Status Word: With failure status for PLC battery, scan overrun, communications, I/O, special functions.

Power Up: PLC checks status of PROMs upon power up; runs self-diagnostics on power-up; periodically runs self-diagnostics while in RUN mode, halts logic processor and sets outputs to configured state if fatal error is detected.

Diagnostic Tables: Tables, displayable by programming computer, that describe nature and location (address) existing faults and errors.

Agency Approvals and Standards:

UL listed.

CSA certified.

DIN Standard 41494.

IEC-65A/WG6 draft proposal.

Factory Mutual approved.

Manufacturer and Product: Allen-Bradley; Model 1769-L33ER.

Random Access Memory (RAM):

Type: CMOS type.

Word Size: 16 bits, minimum.

Battery Backup: 3 months, minimum.

Memory Size: Sufficient to implement all applications software plus 100 percent spare.

Memory Size: 32 K words of ladder logic memory 8 K words of variable memory, plus required overhead for standard functions.

Read only memory (ROM) for controller's operating system and diagnostics.

Power Supply:

Voltage: 24 VDC.

Max input power: 100 VA.

Max in-rush current: 30 A.

Mounting: DIN rail.

Manufacturer: Allen-Bradley; Model 1769-PB4.

Input/Output:

Digital Input Modules:

Voltage: 24 VDC.

Points per Module: 16.

LED status indicator for each point.

Isolation: 125V continuous, inputs-to-backplane and input group-to-group.

Manufacturer: Allen-Bradley; Model 1769-IQ16.

Analog Input Modules:

Voltage: 24V dc.

Power: 3 watts.
Points Per Module: 4 individually isolated.
Input: 4-20mA.
Isolation: 710V dc field-wiring-to-backplane, 710V dc field-wiring-to-chassis-ground.

Analog Input Resolution: 16 bits.
Manufacturer: Allen-Bradley; Model 1769-IF4I.

Analog Output Modules:

Voltage: 24 volts dc.
Power: 2.7 watts.
Isolated Analog Outputs Per Module: 4 differential outputs.
Output: 4-20mA.
Isolation: 30V continuous or 710dc for 1 minute, output group-to-bus.
Analog Output Resolution: 16 bits.
Manufacturer: Allen-Bradley; Model 1769-OF4CI.

Left End Cap:

Manufacturer: Allen-Bradley; Model 1769-ECL.

Identification:

Nameplates installed above/below each PLC component (CPU, I/O rack, power supply).
Label configured I/O points as they have been configured (addressed) in the system, as approved by the Engineer.

Manufacturers and Products:

Allen-Bradley; Compact Logix L33ER processor with 1769 Compact I/O system.

Y176 Panel Mounted Operator Interface Terminal (OIT):

Provide a panel mounted touchscreen to allow the operator to interface with the control system, view status of and manipulate plant equipment, and manage alarms.

Features:

Screen size: 10 inches, minimum.
Resolution: 800 x 600, minimum.
LED Backlight.
Color Display.

Physical:

Input voltage: 24VDC.
Max power consumption: 14 W.

Communications:

RJ-45 Ethernet port.
Compatible with EtherNet/IP communications network protocol.

Software:

Compatible with reading from and writing to CompactLogix L33ER processor tags.

Install PanelView 800 firmware version 4.012 or later and Connected Components Workbench software version 10.01 or later.

Accessories: Include Micro-SD card with unit.

Manufacturer and Product: Allen-Bradley; PanelView 800 or equal product series

Y237 Panel Power Supply:

General:

Panel power supply accepting AC input and converting to DC output.

Features:

UL 508 listed.
Short-circuit protection (automatic shutdown and restart)
Internal fuse protection
LED status display

Physical:

Mounting: DIN Rail
Input Voltage: 120 VAC
Output Voltage: 24 VDC
Output Current: 4.2A

Environmental:

Operating Temperature: Minus 25 degrees C to 70 degrees C

Manufacturer:

Phoenix Contact STEP-PS 1AC/24DC/4.2
Sola
Allen-Bradley
Siemens
Or equal.

Y239 Uninterruptible DC Power Supply:

General:

24V dc UPS
Type: Capacitor or battery.

Features:

UL508 listed.
Reverse polarity protection.
LED status light

Physical:

Mounting: DIN Rail
Input Voltage: 24 VDC
Output Voltage: 24 VDC
Output Current: 15 A
Energy Content: 2.5 kW

Environmental:

Operating Temperature: 0 degrees C to 60 degrees C.

Manufacturers:

Siemens SITOP 6EP1933-2EC41
Phoenix Contact
Allen-Bradley

Sola
Or equal.

Supplement 2 – Collier County SCADA Integration Standards:

SCADA Integration Policy

Any project that has SCADA integration or deals, touches, impacts SCADA, PLC or any component or instrument tied to the SCADA systems at any Plant, collection or distribution system shall follow these guidelines.

Project SCOPE

In the project scope,

- All SCADA integrations must be defined.
- All SCADA systems to be manipulated must be defined.
- All PLCs to be manipulated must be defined
- All logic and process changes must be clearly written down and validated by SCADA integration team.

INTEGRATION SUBMITTAL PLAN

- **Must be submitted with every project or integration effort performed on County SCADA**
- **Upon completion of Integration work, the 'As Built' SCADA information must be finalized and the Integration Plan updated accordingly**
- **SCADA is comprised of three groupings of systems:**
 - **FIELD**
 - **NETWORK**
 - **HOST**
- **Each system must be specifically represented in the Integration Plan provided**

FIELD (PLC, Instrumentation, Wiring, Panels, UPS)

Instrumentation/Hardware to be added/replaced

- Process variable list for each instrument (spreadsheet form) must be provided including:
 - Point Tag name

- Data type
- Scale range

SCADA integrator must provide a complete list all PLCs that will be touched and changes made and documented with the following information (spreadsheet form):

- SCADA System
- PLC Name
- PLC tag names
 - Instrumentation Tags
 - Pseudo (Calculations) Tags
- PLC processes

SCADA PLC Hardware Modifications

- PLC I/O Active – complete list of all active I/O
- PLC I/O Available – hardware address of all available I/O (chassis, slot, card, point)
- PLC Panel I/O requirements – PID Drawing from Design

SCADA Network (Communications Infrastructure, Switch, UPS)

- Network Hardware to be added/replaced
 - Provide configuration
 - Firmware revision level
 - Contact information
 - Service Provider
 - Contract Information
 - Licensing Information
 - Software required
- SCADA Network connectivity available
 - Fiber Optic
 - Switch Port Density
 - Radio frequency – azimuth required
- SCADA Network connectivity required
 - Fiber Optic
 - Switch Port Density
 - Radio frequency – azimuth required

SCADA Host (Server, Workstations, WebSpace, Hardware/Software, UPS)

Host Hardware to be added/replaced

- Hardware physical requirements
- Hardware technical requirements
- Hardware location

Host Software to be added/replacing

- Software technical requirements

SCADA integrator must provide a complete list of operator interface screens that will be touched and suggested changes made.

- SCADA Server Name
- SCADA machine name
- SCADA Historian
- SCADA WebSpace name
- Touchscreen names

SCADA integrator must provide a list of anticipated HOST database points to be:

- Modified
- Added
- Deleted

SCADA integrator must provide a list of anticipated Historian database points to be:

- Modified
- Added
- Deleted

Before beginning work

SCADA integrator must review an Architectural Diagram of the SCADA system on which the work is to be performed.

SCADA integrator must receive a handbook of policies and procedures and Standards of how the specific SCADA system is networked, the application version that is running, the database structure and location of all files used to perform its normal operations.

SCADA integrator must have knowledge of existing CC PUD SCADA platforms (HOST, NETWORK, and FIELD).

SCADA integrator must receive a plant tour and pertinent contact sheets of persons who will allow access to the existing SCADA system, including login and password.

SCADA integrator must perform a complete system DB backup, PLC system backup, network infrastructure system backup,

SCADA integrator must provide a schedule of all integration services to be performed broken out by functionality in:

- FIELD
- NETWORK
- HOST

Onsite

SCADA integrator must perform a complete system DB backup, PLC system backup, network infrastructure system backup.

SCADA integration must be planned accordingly and provided on a detailed schedule.

SCADA integration must coordinate all work with SCADA integration team as well as system and plant operations personnel.

SCADA integration must **NOT** be completed on Fridays of any schedule.

SCADA integrator must provide a detailed scope of functionality to achieve each day, which supports a Roll Back Plan.

Testing

SCADA Integration test plans must be provided for all additions, deletions or modifications in each of the three specific groupings of functionality:

- FIELD
- NETWORK
- HOST

SCADA integration must be tested thoroughly before placed into a live Production environment in the control process.

SCADA integration test plans must be approved by the SCADA integration team or a designee thereof.

Close Out

SCADA Integrator must provide a complete list of database points added, modified, deleted for each system:

- SCADA
- HISTORIAN
- WebSpace
- PLC
 - Instrumentation PV
 - Pseudo (Calculation)

SCADA integrator must provide a complete list of operator interface screens that were touched and changes made.

SCADA integrator must prove to PUD PM, PUD SCADA Team and plant operations the documentation of each new point added, modified, deleted and its validation of accuracy and effectiveness in the integration.

SCADA integrator must provide a SOP type document of how the process was altered and how the operators will now manage the process.

Back Out (Roll Back) Plan

Operations must be able to control, in an automated fashion, the functionality of the station each night, unless other provisions are discussed, documented and confirmed with operations.

Each integration plan must be documented to support overnight automated functionality.

Each integration plan must have a roll back plan that ensures the existing system can be brought back on line and ensure original functionality in a reasonable amount of time.

Each day, in the midafternoon, operations and integration staff will confirm with integrator that the progress made is acceptable and whether or not the roll back plan will be implemented in support of regaining automated control.