FULTON COUNTY

INVITATION TO BID 13ITB072213K-NH

S-126 Sullivan Wastewater Pump Stations Improvements

For

DEPARTMENT OF WATER RESOURCES

BID DUE DATE AND TIME: **SEPTEMBER 13, 2013 11:00 A.M.**
BID ISSUANCE DATE: **August 5, 2013**
PRE-BID CONFERENCE DATE: **AUGUST 23, 2013**
PURCHASING CONTACT: **Nancy Harrison, Assistant Purchasing Agent**
E-MAIL: **nancy.harrison@fultoncountyga.gov**

LOCATION: FULTON COUNTY DEPARTMENT OF PURCHASING & CONTRACT COMPLIANCE
130 PEACHTREE STREET, S.W., SUITE 1168
ATLANTA, GA 30303

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INVITATION TO BID

BID #13ITB072213K-NH

SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS

Sealed Bids for furnishing all materials, labor, tools, equipment and appurtenances necessary to replace the pumps and supporting equipment at the Sullivan Road Pump Stations #1 thru #4 will be received by the Fulton County Department of Purchasing and Contract Compliance at 130 Peachtree Street, S.W. Suite 1168 Atlanta, GA 30303, **no later than 11:00 a.m.,** local time, on **September 13, 2013.**

SCOPE OF WORK

The Project consists of the following major elements: replacement of twelve dry pit pumps with dry pit submersible pumps in **four separate pump stations** (three pumps per station), piping and valve replacement, Motor Control Center replacement, replacement of four of the existing diesel backup generators and installation of a new bypass and flow meter system at each pump station. The detailed scope of work and technical specifications are outlined in the Division of Work Section 01 10 00, Summary and Scope of Work of this bid document.

BID DOCUMENTS

This document and supporting documents can be downloaded at the Fulton County Website, http://www.fultoncountyga.gov under "Bid Opportunities".

The Bid Documents and Drawings for this project may be examined at the following locations.

McGraw Hill Construction Dodge
3200 Riverside Dr
STE 310
Macon, Georgia 31210

Fulton County
Water Resources Department
STE 6001
141 Pryor ST, S.W., 6th Floor
Atlanta, Georgia 30303

AGC Builders Exchange
1940 The Exchange
STE 300
Atlanta, Georgia 30339

CMD / Construction Market Data
30 Technology Blvd
STE 100
Norcross Georgia 30092

FW Dodge Corporation
4170 Ashford-Dunwoody Rd
STE 200
Atlanta, Georgia 30319

Minority Business Development Agency
401 West Peachtree St
Summit Bldg STE 1715
Atlanta Georgia 30308

Applications for documents, along with a non-refundable $50.00 payment must be made to the Department of Water Resources, 141 Pryor Street, SW, Suite 6001, Atlanta, GA 30303. Payment must be in the form of a company or personal check payable to Fulton County Department of Water Resources. Checks returned for any reason will result in the bid being

deemed non-responsive. The amount includes all fees for printing and distribution and will be used to defray a portion of the printing cost that may have been incurred for the tendering of the Project. Partial sets of the bid document will not be issued. For payment information, contact Keithly Wynter, Department of Water Resources. All other questions should be addressed by the procedures outlined in this ITB to Nancy Harrison, Fulton County Department of Purchasing and Contract Compliance at nancy.harrison@fultoncountyga.gov.

A copy **(FOR VIEWING PURPOSES ONLY) of the Drawings** will be available in the Department of Purchasing & Contract Compliance Plan Room located at 130 Peachtree Street, S.W. Suite 1168, Atlanta, Georgia 30303.

PURCHASING CONTACT

Information regarding the bid or bid requirements, either procedural or technical, may be obtained by submitting questions in writing to:

Fulton County Government
Department of Purchasing & Contract Compliance
Attn: Nancy Harrison, Assistant Purchasing Agent
Fulton County Public Safety Building
130 Peachtree Street, S.W. Suite 1168
Atlanta, GA 30303
Email: nancy.harrison@fultoncountyga.gov

Fax: 404-893-1744
Reference Bid #: 13ITB072213K-NH

PRE-BID CONFERENCE

Pre-Bid Conference
Date: Friday, August 23, 2013
Time: 1:00 PM
Location: Sullivan Pump Station #1
8345 Gorgans Ferry Road
Sandy Springs, GA

A Pre-Bid Conference will be held at the Sullivan Wastewater Pump Station #1 jobsite, immediately followed by a site tour to allow potential bidders to inspect the facility. ***Inquiries regarding the solicitation either technical or otherwise may be submitted in writing prior to the pre-bid conference and will be addressed at the pre-bid conference.***

Any additional questions asked at the Pre-Bid Conference must be submitted in written form and will be responded to in the form of an addendum with the County's official responses.

The Pre-Bid Conference will be conducted for the purpose of explaining the County's bid process, the specifications/technical documents, and to provide non-binding verbal responses to questions concerning these bid specifications and to discuss issues from the Bidders perspective. However, no verbal response provided at the Pre-Bid Conference binds the County. Only those responses to written questions that are responded to by the County in written communications will be official.

BONDING REQUIREMENTS

Each Bid must be accompanied by a Bid Bond, prepared on the Bid Bond provided in this Bid Document or a Surety Company's Standard Bid Bond, duly executed by the Bidder as principal and having as surety, a surety company licensed to do business in the State of Georgia by the Georgia Insurance Commissioner and listed in the latest issue of U.S. Treasury Circular 570, in the amount of fiver percent of the Bid.

The successful Bidder for this Contract will be required to furnish a satisfactory Performance and Payment Bond each in the amount of 100 percent of the Bid, and proof of insurance in accordance with the requirements set forth in Section 5 of this Bid Document.

END OF SECTION

OWNER - CONTRACTOR AGREEMENT

PROJECT NUMBER: S126
S126 SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS

Contractor: _____ Project No. _____

Address: _____ Telephone: _____

Contact: _____ Facsimile: _____

THIS AGREEMENT is effective as of the _____ day of _____, 2013, by and between Fulton County, a political subdivision of the State of Georgia (hereinafter called the "County"), and the above named CONTRACTOR in accordance with all provisions of this Construction Agreement ("Contract"), which consists of the following: Owner-Contractor Agreement, Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, general conditions, special conditions, scope of work and specifications, plans, drawings, exhibits, addenda, Purchasing forms, Office of Contract Compliance Forms, Risk Management insurance provisions forms and written change orders.

The specific Exhibits of this Contract are as follows:

Exhibit A: General Conditions
Exhibit B: Special Conditions (if applicable)
Exhibit C: Addenda
Exhibit D: Bid Form
Exhibit E: Bonds (Bid, Payment & Performance)
Exhibit F: Scope of Work and Technical Specifications
Exhibit G: Exhibits
Exhibit H: Purchasing Forms
Exhibit I: Office of Contract Compliance Forms
Exhibit J: Risk Management Insurance Provisions Forms

WITNESSETH: That the said Contractor has agreed, and by these present does agree with the said County, for and in consideration of a Contract Price of **[INSERT CONTRACT AMOUNT IN WORDS]**, ($**[INSERT CONTRACT AMOUNT IN NUMBERS]**) and other good and valuable consideration, and under the penalty expressed on Bonds hereto attached, to furnish all equipment, tools, materials, skill, and labor of every description necessary to carry out and complete in good, firm, and workmanlike manner, the Work specified, in strict conformity with the Drawings and the Specifications hereinafter set forth, which Drawings and Specifications together with the bid submittals made by the Contractor, General Conditions, Special Provisions, Detailed Specifications, Exhibits, and this Construction Agreement, shall all form essential parts of this Contract. The Work covered by this Contract includes all Work indicated on Plans and Specifications and listed in the Bid entitled:

PROJECT NUMBER: S126
SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS

The Contractor, providing services as an Independent Contractor, shall commence the Work with adequate force and equipment within 10 days from receipt of Notice to Proceed ("NTP") from the County, and shall complete the work within four hundred eighty five (485) calendar days from the Notice to Proceed or the date work begins, whichever comes first. The Contractor shall remain responsible for performing, in accordance with the terms of the Contract, all work assigned prior to the expiration of the said calendar days allowed for completion of the work even if the work is not completed until after the

expiration of such days. The Contractor shall agree that in the performance of this Contract he will comply with all lawful agreements, if any, which the contractor has made with any association, union or other entity, with respect to wages, salaries and working conditions, so as to cause inconvenience, picketing or work stoppage.

For each calendar day that any work remains uncompleted after the time allowed for completion of the work, the Contractor shall pay the County the sum of $ 500.00 not as a penalty but as liquidated damages, which liquidated damages the County may deduct from any money due the contractor. At the County's convenience and not to it prejudice the County may provide written notice of the commencement of the assessment of liquidated damages.

As full compensation for the faithful performance of this Contract, the County shall pay the Contractor in accordance with the General Conditions and the prices stipulated in the Bid, hereto attached.

It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Surety Bonds hereto attached for its faithful performance, the County shall deem the surety or sureties upon such bonds to be unsatisfactory, or, if, for any reason, such bonds cease to be adequate to cover the performance of the Work, the Contractor shall, at his expense, within five days after receipt of notice from the County so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the County. In such event no further payment to the Contractor shall be deemed to be due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the County.

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or Construction Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the Construction Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the Construction Manager, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County, in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor. **[See General Conditions for similar provision]**

This Contract constitutes the full agreement between the parties, and the Contractor shall not sublet, assign, transfer, pledge, convey, sell or otherwise dispose of the whole or any part of this Contract or his right, title, or interest therein to any person, firm or corporation without the previous consent of the County in writing. Subject to applicable provisions of law, this Contract shall be in full force and effect as a Contract, from the date on which a fully executed and approved counterpart hereof is delivered to the

Contractor and shall remain and continue in full force and effect until after the expiration of any guarantee period and the Contractor and his sureties are finally released by the County.

This agreement was approved by the Fulton County Board of Commissioner on [Insert approval date and item number].

[SIGNATURES NEXT PAGE]

IN WITNESS THEREOF, the Parties hereto have caused this Contract to be executed by their duly authorized representatives as attested and witnessed and their corporate seals to be hereunto affixed as of the day and year date first above written.

OWNER:

FULTON COUNTY, GEORGIA

John H. Eaves, Commission Chair
Board of Commissioners

ATTEST:

Mark Massey
Clerk to the Commission (Seal)

APPROVED AS TO FORM:

Office of the County Attorney

APPROVED AS TO CONTENT:

[Insert Department Head Name]
[Insert Department Head Title]

CONTRACTOR:

[Insert Contractor COMPANY NAME]

[Insert Name & Title of person authorized to sign contract]

ATTEST:

Secretary/
Assistant Secretary

(Affix Corporate Seal)

END OF SECTION

INSTRUCTIONS TO BIDDERS

1. CONTRACT DOCUMENTS

The Contract Documents include the Contract Agreement, Contractor's Bid (including all documentation accompanying the Bid and any post-Bid documentation required by the County prior to the Notice of Award), Bonds, all Special Conditions, General Conditions, Supplementary Conditions, Specifications, Drawings and addenda, together with written amendments, change orders, field orders and the Construction Manager's written interpretations and clarifications issued in accordance with the General Conditions on or after the date of the Contract Agreement.

Shop drawing submittals reviewed in accordance with the General Conditions, geotechnical investigations and soils report and drawings of physical conditions in or relating to existing surface structures at or contiguous to the site are not Contract Documents.

The Contract Documents shall define and describe the complete work to which they relate.

2. BID PREPARATION

Bidders shall **SUBMIT ONE (1) ORIGINAL, SIGNED AND DATED, AND TWO (2) COPIES** on the forms provided in the Bid Document.

All bids must be made on the bid forms contained herein and shall be subject to all requirements of the Agreement Documents. All bids must be regular in every respect and no interlineations, excisions, or special conditions shall be made or included in the bid by the Bidder.

Lump sum, unit price and extensions of unit prices must be entered in the appropriate spaces provided on the Bid Schedule/Bid Form. Unit prices shall include an appropriate allocation of overhead and other indirect costs so that the summation of unit price extensions and lump sum items represents the total bid amount. All blank spaces must be typed or hand written in blue ink on the “Original”. All dollar amounts must be BOTH in writing and figures and represent prices for the published scope of work without exceptions.

The County may, in its sole discretion, reject any bid determined as irregular, a conditional bid or any bid on which there is an alteration of, or departure from the Bid Schedule attached.

Erasures or other changes in the bids must be explained or noted over the signature of the Bidder. All corrections to any entry must be lined out and initialed by the Bidder. Please do not use correction tapes or fluid. Failure to do so shall render the Bidder as non-responsive and cause rejection of the bid.

Failure to execute the Bid Schedule/Bid Form documents may result in Bidder being deemed non-responsive and cause rejection of the bid.

3. RECEIPT AND OPENING OF BIDS

Sealed bids will be received by the Fulton County Department of Purchasing & Contract Compliance at Fulton County Public Safety Building, 130 Peachtree Street, S.W., Suite 1168

Atlanta, Georgia 30303. The original signed Bid with three (3) copies shall be submitted in a sealed envelope, addressed to the Department of Purchasing and Contract Compliance and labeled **ITB Number 13ITB072213K-NH Sullivan Wastewater Pump Stations Improvements** REQUIRED SUBMITTALS: The bidder must complete and execute the following:

1. Bid Form
2. Acknowledgement of each Addendum
3. Bid Bond
4. Purchasing Forms (See Submittal Check List at end of this Section), fully executed
5. Contract Compliance Forms (See Submittal Check List at end of this Section), fully executed
6. Risk Management Insurance Provisions Form

Any bids received after the stated time and date will not be considered. It shall be the sole responsibility of the bidder to have his/her bid delivered to the Fulton County Department of Purchasing and Contract Compliance for receipt on or before the stated time and date (see Section 00020). If a bid is sent by U.S. Mail, the bidder shall be responsible for its timely delivery to the Purchasing Department. Bids delayed by mail will not be considered, shall not be opened, and arrangements shall be made for their return at the bidder's request and expense.

Bid shall be publicly opened, with only the names and total bid price of the bidders disclosed at the opening.

4. ADDENDA AND INTERPRETATIONS

No interpretations of the meaning of the Drawings, Specifications or other pre-bid documents will be made to any Bidder orally. Bidders requiring clarification or interpretation of the Contract Documents shall make a request in writing, either by mail, hand delivery, e-mail or fax, to the Purchasing Agent at the address below. To be given consideration, requests must be received no later than 2:00 PM, **August 26, 2013**. The County will not respond to any requests, oral or written, received after this date. Telephone inquiries will not be accepted.

Department of Purchasing and Contract Compliance
Attn: Nancy Harrison, Assistant Purchasing Agent
Fulton County Public Safety Building
130 Peachtree Street, S.W., 1168
Atlanta, GA 30303
Fax: (404) 893-1744
Nancy.harrison@fultoncountyga.gov
Bid # 13ITB072213K-NH

Only communications from firms that are in writing and signed will be recognized by the County as duly authorized expressions on behalf of proposers/bidders. Any and all such interpretations and any supplemental instructions will be in the form of written Addenda to the Specifications which, if any addend are issued to this Invitation to Bid.

Failure of Bidders to receive or acknowledge any Addendum shall not relieve them of any obligation under the Bid. All Addenda shall become part of the Contract Documents.

5. SITE EXAMINATION

There will be a site visit for this project. It will be held on **August 23, 2013**. Bidders **(are not)** required to attend.

6. BIDDER'S MODIFICATION AND WITHDRAWAL OF BIDS

A Bidder may modify or withdraw its bid by written request, provided that the request is received by the County prior to the bid due date and time at the address to which bids are to be submitted. Provided further, that in case of an electronic request (i.e. facsimile, e-mail, etc.) a written confirmation thereof over the authorized signature of the Bidder must be received by the County at the address to which original Bids are to be submitted within three (3) calendar days after issue of the electronic message. Following withdrawal of its bid, the Bidder may submit a new bid, providing delivery is affected prior to the established bid opening date and time**. No bid may be withdrawn after bid due date for sixty (60) calendar days.**

7. BID AND CONTRACT SECURITY

A Bid Bond for an amount equal to five percent (5%) of the bid amount must accompany each Proposal. The bid bond shall be submitted in a separate, sealed envelope marked "Bid Bond".

Bids must be accompanied by a bid bond or certified check in an amount of five percent (5%) of the TOTAL AMOUNT of the base bid. The bid bond or certified check shall apply ONLY TO THIS BID. The bid name and contract number must appear on the security instrument. The bond must remain in full force and effect until the Bidder executes the final Contract. Bids not satisfying the bonding requirements of this project will be declared non-responsive.

Any bid bond, performance bond, payment bond, or security deposit required for public works construction contract shall be approved and filed with purchasing agent. At the option of the County, if the surety named in the bond is other than a surety company authorized by law to do business in this state pursuant to a current certificate of authority to transact surety business by the Commissioner of Insurance, such bond shall not be approved and filed unless such surety is on the United States Department of Treasury's list of approved bond sureties.

A Purchasing Agent shall approve as to form and as to the solvency of the surety any bid bond, performance bond, or payment bond required by this. In the case of a bid bond, such approval shall be obtained prior to acceptance of the bid or proposal. In the case of payment bonds and performance bonds, such approval shall be obtained prior to the execution of the contract.

Whenever, in the judgment of the County:

(1) Any surety on a bid, performance, or payment bond has become insolvent;
(2) Any corporation surety is no longer certified or approved by the Commissioner of Insurance to do business in the state; or
(3) For any cause there are no longer proper or sufficient sureties on any or all the bonds

The County may require the contractor to strengthen any or all of the bonds or to furnish a new or additional bond or bonds within ten days. Thereupon, if so ordered by the County, all work on the contract shall cease unless such new or additional bond or bonds are furnished. If such

bond or bonds are not furnished within such time, the County may terminate the contract and complete the same as the agent of and at the expense of the contractor and his or her sureties.

As a condition of responsiveness the bidder must contain a Bid Bond for an amount equal to 5% of the bid amount. The Bid Bond shall be included in a separate envelope marked on the outside "Bid Bond". Checks or letters of credit of any type will not be accepted. A certified cashier's check will be acceptable. Provide a completed and fully executed Bid Bond. When the bidder's package is opened, a purchasing agent will verify the presence of the Bid Bond and remove it from the Proposal Package.

If the bidder withdraws its bid from the competition after the selection of its bid for a reason not authorized by Georgia law, the County will proceed on the Bid Bond, along with any other available remedies.

The Surety of the Bid Bond shall be from a surety company authorized to do business in the State of Georgia, shall be listed in the Department of Treasury Circular 570, and shall have an underwriting limitation in excess of 100% of the bid amount. The Bonds and Surety shall be subject to approval by the County Attorney.

Attorneys-in-fact for bidders who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

8. SURETY BONDS

The submission of surety bonds subsequent to the Bid submission shall be:

a. Any surety bond submitted in accordance with the Bid or Agreement requirements must be issued by a corporate surety company satisfactory to the Commission and authorized to act as such in the State of Georgia;

b. Such bonds shall conform to the forms provided with the Bid Documents and be completed in accordance with the instructions thereon; and

c. In accordance with Georgia law, and upon award of the Agreement, separate performance and payment bonds shall be required of the successful Bidder, each in an amount not less than the total amount payable under the Agreement. The performance bond shall remain in effect for one (1) year after final acceptance of the Work or the guaranty period under the Agreement, whichever is the larger.

The payment bond shall remain in effect for the period required under Georgia law for the payment bonds on public construction agreements. Reference is made to the bond forms and the Agreement Documents for additional particulars of the terms required in the bonds. In the case of any inconsistency between the Bond Forms and Georgia law, the law shall control. Alterations, extension of the time allowed for performance, extra and additional Work, and other changes authorized under the Agreement may be made without notice to or consent of the surety or sureties.

9. INSURANCE REQUIREMENTS

The Contractor shall procure and maintain during the life of this Agreement, Workmen's Compensation, Public Liability, Property Damage, Automobile Liability insurance and any other insurance necessary to satisfy the requirements of the Agreement Documents.

10. RIGHT TO REJECT BIDS

The County reserves the right to reject any or all bids and to waive informalities. No bids will be received after the time set for opening bids. Any unauthorized conditions, limitations or provisions attached to the Bid, except as provided herein, will render it informal and may cause its rejection. Unbalanced bids will be subject to rejection. Any bidder may withdraw his/her bid, either personally or by telegraphic or written request, at any time prior to the scheduled closing time for receipt of bids. Telegraphic or written requests for withdrawal must be in the possession of the County prior to the closing time for receipt of bids.

11. APPLICABLE LAWS

All applicable laws and regulations of the State of Georgia and ordinances and regulations of Fulton County shall apply. Protestors shall seek resolution of their complaints in the manner provided in the Fulton County Code of Laws §2-324, which is incorporated by reference herein.

12. EXAMINATION OF CONTRACT DOCUMENTS

Prospective bidders shall examine the contract documents and before submitting a bid, shall make a written request to the County for an interpretation or correction of any ambiguity, in consistency or error therein which could be discovered by a bidder. At the bid opening each bidder shall be presumed to have read and be familiar with the contract documents**.**

13. BID EVALUATION

a. Each Bid timely received and in the County's hands at the time set forth for the Bid opening shall constitute an offer to perform the Agreement on the terms and conditions thereof, in strict accordance with the Agreement documents, and all other requirements, all for the Bid total. For good cause and valuable consideration, the sufficiency of which is acknowledged by submittal of a Bid, each Bidder promises and agrees that its Bid shall be irrevocable for a period of ***sixty calendar days*** after the Bid opening and will not be withdrawn or modified during that time. The County may accept any Bid by giving the Bidder Written Notice of acceptance during that time. If necessary, the period of time specified may be extended by written agreement between the County and the Bidder or Bidders concerned.

b. After the Bids have been opened and before any award is made, the County will evaluate the Bid process, the Bid total, the supplements to the Bid form, Bidder's experience, proposed Subcontractors and equipment manufacturers and other data relating to Bidders' responsibility and qualifications to perform the Agreement satisfactorily.

c. All extension of the unit prices shown and the subsequent addition of extended amounts may be verified by the County. In the event of a discrepancy between the unit price bid and the extension, the unit price will be deemed intended by the

Bidder and the extension shall be adjusted. In the event of a discrepancy between the sum of the extended amounts and the bid total, the sum of the extended amounts shall govern.

d. Bidder may be required to submit, in writing, the addresses of any proposed Subcontractors or Equipment manufacturers listed on the Bid, and to submit other material information relative to proposed Subcontractors or Equipment manufacturers. The County reserves the right to disapprove any proposed Subcontractor or Equipment manufacturers whose technical or financial ability or resources or whose experience are deemed inadequate.

e. The County reserves the right to reject any Bid the prices of which appear to be unbalanced, and to reject any or all Bids, or parts thereof, if it determines, in its sole discretion, that such rejection is in the best interest of the Commission. Where only a single responsible and responsive Bid is received, the County may in its sole discretion, elect to conduct a price or cost analysis of the Bid. Such Bidder shall cooperate with such analysis and provide such supplemental information as may be required. The determination whether to enter into an Agreement with such sole Bidder shall be solely within the County's discretion and not dependent upon performance of a price or cost analysis.

f. Bids will be evaluated on the basis of determining the lowest Bid total of a Bidder, not including alternates, whose Bid is responsive to the Invitation to Bid and who is determined to be technically, financially and otherwise responsible to perform the Agreement satisfactorily, and to meet all other requirements of the Bidding Documents relating thereto. Any Bid may be rejected if it is determined by the County to be non-responsive, provided, however, that the Commission reserves the right to waive any irregularities or technicalities which it determines, within its sole discretion, to be minor in nature and in the interest of the public. Furthermore, any Bid may be rejected if it is determined by the County, in its sole discretion, that the Bidder is not capable of performing the Agreement satisfactorily based upon review of its experience and technical and financial capabilities, or the failure of such bidder to provide information requested relating to such determination. Additionally, the County reserves the right to disqualify Bids, before and after the bid opening, upon evidence of collusion with intent to defraud or other illegal practices upon the part of any Bidder(s).

g. The County intends to award the Agreement at the earliest practicable date to the lowest responsive, responsible Bidder(s), provided that the Bid is within the funds available for the project. In addition, the Commission reserves the right to reject all Bids if it determines, in its sole discretion, that the public interest will be best served by doing so.

h. A Pre-award Conference may be conducted with the apparent low Bidder(s) to review general requirements of the Bidding Documents.

14. AWARD CRITERIA

Award will be made after evaluating the prices, responsiveness and responsibility of each Bidder**.**

A. Responsiveness: The determination of responsiveness will be determined by the following:

   a. The completeness of all material, documents and/or information required by the County;
   b. Whether the bidder has submitted a complete Bid form without irregularities, excisions, special conditions, or alternative bids for any item unless specifically requested in the Bid form.

B. Responsibility: The determination of the bidder's responsibility will be determined by the following

   a. The ability, capacity and skill of the Bidder to perform and/or provide the Work required;
   b. The County reserves the right to reject any bid if the evidence submitted by, or investigation of, the bidder fails to satisfy the County that he/she is properly qualified to carry out the obligations of the Contract;
   c. The character, integrity, reputation, judgment, experience and efficiency of the Bidder;
   d. The quality of performance of work on previous contracts or work; Maintains a permanent place of business individually or in conjunction with the prime contractor.
   e. Has the appropriate and adequate technical experience necessary to perform the Work;
   f. Has adequate personnel and equipment to do the Work expeditiously;
   g. Has suitable financial means to meet obligations incidental to the work**.**

15. DISQUALIFICATION OF BIDDERS

Any of the following may be considered as sufficient for disqualification of a Bidder and the rejection of the Bid:

a. Submission of more than one Bid for the same work by an individual, firm, partnership or Corporation under the same of different name(s);

b. Evidence of collusion among Bidders;

c. Previous participation in collusive bidding on Work for the County;

d. Submission of an unbalanced Bid, in which the prices quoted for same items are out of proportion to the prices for other items;

e. Lack of competency of Bidder. The Agreement will be awarded only to a Bidder(s) rated as capable of performing the Work.

16. BASIS OF AWARD

The Contract, if awarded, will be awarded to the lowest responsive and responsible bidder. No bid may be withdrawn for a period of sixty (60) days after the date of bid opening

except as permitted by O.C.G.A., §36-91-41 et seq., as amended. Each Bid must be accompanied by a Bid Bond in accordance with the Bid Bond Requirements provided in the Contract Documents, on a Surety Company's Standard Bid Bond Form acceptable to the County in an amount no less than 5% of the amount bid. The successful bidder will be required to furnish a Performance Bond and Payment Bond, **on or before** the issuance of Notice to Proceed, each in the amount of 100% of the Contract Amount. All other required Contract Documents must be fully completed and executed by the Contractor and his/her Surety, and submitted to the Owner **on or before** the issuance of the Notice to Proceed.

17. PROFESSIONAL LICENSES

The State of Georgia requires that the following professions are required by state law to be licensed:

1. Electricians
2. Plumbers
3. Conditioned Air Contractors
4. Low voltage Contractors

Bidders and any sub-contractors performing any of the above described work must provide a copy of their license for the work they will perform on this project. Bidders must complete Form C3: Georgia Professional License Certification in Section 6, Purchasing Forms Failure to provide the required license may deem your bid non-responsive.

18. WAGE CLAUSE

Pursuant to 102-391, Each Contractor shall agree that in the performance of the Contract he will comply with all lawful agreements, if any, which the Contractor had made with any association, union, or other entity, with respect to wages, salaries, and working conditions, so as not to cause inconvenience, picketing, or work stoppage.

19. NOTICE OF AWARD OF CONTRACT

As soon as possible, and within sixty (60) days after receipt of bids, the County shall notify the successful Bidder of the Award of Contract.

The award shall be made by the Board of Commissioners of Fulton County to the lowest responsive, responsible bidder(s) as soon as possible after receipt of bids, taking into consideration price and the responsiveness to the requirements set forth in the Invitation for Bid. In such case, no claim shall be made by the selected Contractor(s) for loss of profit if the contract is not awarded or awarded for less work than is indicated and for less than the amount of his bid. The total of the awarded contract shall not exceed the available funds allocated for this project.

Should the County require additional time to award the contract, the time may be extended by mutual agreement between the County and the successful bidder. If an Award of Contract has not been made within sixty (60) days from the bid date or within the extension mutually agreed upon, the Bidder may withdraw the Bid without further liability on the part of either party.

Any award made by the Board of Commissioners as a result of this bid will begin from the date of the notice to proceed. The Bidder agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written order from the user department. The contract shall become effective on the Contract Date and shall continue in effect until the end of the term of the contract or until the project has been closed-out unless earlier terminated pursuant to the termination provisions of the contract.

20. EXECUTION OF CONTRACT DOCUMENTS

Upon notification of Award of Contract, the County shall furnish the Contractor the conformed copies of Contract Documents for execution by the Contractor and Contractor's surety.

Within ten (10) days after receipt the Contractor shall return all the documents properly executed by the Contractor and the Contractor's surety. Attached to each document shall be an original power-of-attorney for the person executing the bonds for the surety and certificates of insurance for the required insurance coverage.

After receipt of the documents executed by the Contractor and his surety with the power-of-attorney and certificates of insurance, the County shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.

Should the contractor and/or surety fail to execute the documents within the time specified, the County shall have the right to proceed on the Bid Bond accompanying the bid.

If the County fails to execute the documents within the time limit specified, the Contractor shall have the right to withdraw the Contractor's bid without penalty.

Should an extension of any of the time limits stated above be required, this shall be done only by mutual agreement between both parties.

Any agreement or contract resulting from the acceptance of a bid shall be on a County approved document form. The County reserves the right to reject any agreement that does not conform to the Invitation for Bid and any County requirements for agreements and contracts. The County reserves the right to modify the agreement resulting from this bid upon the recommendation of the County Attorney.

21. EQUAL EMPLOYMENT OPPORTUNITY ("EEO") IN PURCHASING AND CONTRACTING

To be eligible for award of this Agreement, the Bidder must certify and fully comply with the requirements, terms, and conditions of the County's Non Discrimination in Contracting and Procurement**.**

22. JOINT VENTURE

Any Bidder intending to respond to this solicitation as a joint venture must submit an executed joint venture agreement with its offer. The agreement must designate those persons or entities authorized to execute documents or otherwise bind the joint venture in all transactions with Fulton County, or be accompanied by a document, binding upon the joint venture and its constituent members, making such designation. Offers from joint ventures that do not include these documents will be rejected as being non-responsive.

23. CONTRACTORS COMPLIANCE WITH ALL ASSURANCES AND/OR PROMISES MADE IN RESPONSE TO PROCUREMENT

Should any Bidder submit a response to the County promising to provide a certain level of service for either the scope of work, MFBE participation, or any other matter, including where such promise or assurance is greater than what is required by the procurement documents, and should this response containing the promise or assurance be accepted by the County and made a part of the Contract Documents, then this degree or level of service promised by the bidder relating to the scope of work, MFBE participation, or other matter shall be considered to be a material part of the Agreement between the bidder and the County, such that the bidder's failure to provide the agreed upon degree or level of service or participation shall be a material breach of the Agreement giving the County just cause to terminate the Agreement for cause, pursuant to the General Conditions of the Agreement.

24. GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT

This Invitation to Bid is subject to the Georgia Security & Immigration Compliance Act. Pursuant to the Georgia Security & Immigration Compliance Act of 2006, as amended on May 11, 2009, bidders and proposers are notified that all bids/proposals for services that are to be physically performed within the State of Georgia must be accompanied by proof of their registration with and continuing and future participation in the E-Verify program established by the United States Department of Homeland Security. A completed affidavit must be submitted on the top of the bid/proposal at the time of submission, prior to the time for opening bids/proposals. Under state law, the County cannot consider any bid/proposal which does not include a completed affidavit. It is not the intent of this notice to provide detailed information or legal advice concerning the Georgia Security & Immigration Compliance Act. All bidders/proposers intending to do business with the County are responsible for independently apprising themselves and complying with the requirements of that law and its effect on County procurements and their participation in those procurements. For additional information on the E-Verify program or to enroll in the program, go to: https://e-verify.uscis.gov/enroll.

See Section 6, Purchasing Forms & Instructions for declarations and affidavits.

25. SUBCONTRACTING OPPORTUNITIES

Potential prime contractors submitting a bid on this project for Fulton County and are seeking subcontractors and/or suppliers can advertise those subcontracting opportunities on the County's website, http://www.fultoncountyga.gov under "Subcontracting Bid Opportunities".

26. TERM OF CONTRACT

The term of the Agreement shall be for a period of seven hundred thirty (730) calendar days, or as may be amended under the Agreement to comprise the Agreement Time. Contractor shall commence the Work within ten calendar days after receipt of Notice to Proceed and shall substantially complete the Work within four hundred twenty five (425) calendar days from issuance of the Notice to Proceed and finally complete the Work within four hundred and eighty five (485) calendar days from issuance of Notice to Proceed except as may be amended under the Agreement. It is understood and agreed that the County will sustain monetary and other injury and damages, including but not limited to, increased costs, expenses and liabilities in the

event of failure by the contractor to perform the Work in accordance with this Agreement. Accordingly, should the Contractor not complete the work, or any such portion thereof, within the days required under this Section, then charges shall be assessed against any money due or that may become due the Contractor in accordance with the following schedule:

Substantial Completion: $500 per day
Final Completion: $250 per day

27. NO CONTACT PROVISION

It is the policy of Fulton County that the evaluation and award process for County contracts shall be free from both actual and perceived impropriety, and that contacts between potential vendors and County officials, elected officials and staff regarding pending awards of County contracts shall be prohibited.

A. No person, firm, or business entity, however situated or composed, obtaining a copy of or responding to this solicitation, shall initiate or continue any verbal or written communication regarding this solicitation with any County officer, elected official, employee, or designated County representative, between the date of the issuance of this solicitation and the date of the County Manager's recommendation to the Board of Commissioners for award of the subject contract, except as may otherwise be specifically authorized and permitted by the terms and conditions of this solicitation.

B. All verbal and written communications initiated by such person, firm, or entity regarding this solicitation, if same are authorized and permitted by the terms and conditions of this solicitation, shall be directed to the Purchasing Agent.

C. Any violation of this prohibition of the initiation or continuation of verbal or written communications with County officers, elected officials, employees, or designated County representatives shall result in a written finding by the Purchasing Agent that the submitted Bid or proposal of the person, firm, or entity in violation is "non-responsive", and same shall not be considered for award.

28. AUTHORIZATION TO TRANSACT BUSINESS

If the Contractor is a corporation or corporations combined to form a joint venture, the corporation or members of the joint venture team, prior to Agreement execution, must submit documentary evidence from the Secretary of State that the corporation is in good standing and that the corporation is authorized to transact business in the State of Georgia.

29. PRE-CONSTRUCTION CONFERENCE

A pre-construction conference may be held with the successful Bidder and all known Subcontractors at a time and place set by the County.

30. SUBSTITUTIONS

See Special Conditions Article.

31. RIGHT TO PROTEST

Any actual bidder or offeror that has submitted a bid/proposal for a particular procurement and is aggrieved in connection with the solicitation or award of the contract shall protest in writing to the purchasing agent after the date that the specific bid or proposal is submitted. No protest will be accepted or considered prior to the date the specific bid or proposal is submitted; it will be considered untimely. All protests shall set forth in full detail the factual and legal bases for the protest and specific relief sought by the protestor. Protests arising from factual or legal bases that the protestor knew or should have known prior to the submission of the bid/proposal must be submitted within three business days of the submission of the bid/proposal. Protests arising from factual or legal bases that the protestor knew or should have known subsequent to the date the bid/proposal was submitted must be submitted within ten business days after the protestor knew or should have known of such bases, but in no event shall any protest be submitted more than ten business days after the award of the contract. Untimely protests will not be considered by the purchasing agent and will be simply denied as untimely. Decisions on timeliness by the purchasing agent are not appealable. An oral protest or a protest to an official, employee, User Department, or other person apart from the Director of Purchasing & Contract Compliance does not comply.

32. BID GENERAL CONDITIONS

1. Proposals may be withdrawn upon receipt of a written request prior to the stated due date and time. If a firm seeks to withdraw a proposal after the due date and time, the firm must present a notarized statement indicating that an error was made, with an explanation of how it occurred. The withdrawal request must be accompanied by documentation supporting the claim. Prior to approving or disapproving the request, an opinion will be obtained from Fulton County's Legal Counsel indicating whether the firm is bound by its proposal.

   Proposals for projects that are solicited pursuant to the Georgia Local Government Public Works Construction Law (O.C.G.A. § 36-91-1 et seq.) may be withdrawn as follows:

   The County must advise Offerors in the request for proposals of the number of days that Offerors will be required to honor their proposals. If an Offeror is not selected within 60 days of opening the proposals, any Offeror that is determined by the governmental entity to be unlikely of being selected for contract award will be released from the proposal.

2. Fulton County shall be the sole judge of the quality and the applicability of all proposals. Design, features, overall quality, local facilities, terms and other pertinent considerations will be taken into account in determining acceptability.

3. The successful Offeror must assume full responsibility for delivery of all goods and services proposed.

4. The successful Offeror must assume full responsibility for replacement of all defective or damaged goods and/or performance of contracted services within thirty (30) days' notice by the County of such defect, damage or deficiency.

5. The successful Offeror must assume full responsibility for providing warranty service on all goods, materials, or equipment provided to the County with warranty coverage. Should a vendor be other than the manufacturer, the vendor and not the County is responsible for contacting the manufacturer. The Offeror is solely responsible for arranging for the service to be performed.

6. The successful Offeror shall be responsible for the proper training and certification of personnel used in the performance of the services proposed.

7. The successful Offeror shall not assign, transfer, convey, sublet, or otherwise dispose of any contract resulting from the RFP or of any of its rights, title or interest therein without prior written consent of the Fulton County Board of Commissioners.

8. In case of default by the successful Offeror, Fulton County may procure the articles or services from another source and hold the successful Vendor responsible for any resultant excess cost.

9. All proposals and bids submitted to Fulton County are subject to the Georgia "Open Records Act", Official Code of Georgia, Annotated (O.C.G.A.) § 50-18-70 et seq.

10. All proposals and bids submitted to Fulton County involving Utility Contracting are subject to the Georgia law governing licensing of Utility Contractors, O.C.G.A. §43-14-8.2(h).

33. SUBMITTALS

The following submittals must be completed and submitted with the Bid Submittal. This checklist is provided to ensure that the Bidder submits certain required information with its Bid.

	Bid Submittal Check Sheet	Check (√)
1.	Georgia Security and Immigration Contractor Affidavit(s) and Agreements	
2.	Georgia Security and Immigration Subcontractor Affidavit(s)	
3.	Bid Form	
4.	Acknowledgment of Addenda	
5.	Bid Bond	
6.	Non-Collusion Affidavit	
7.	Certificate of Acceptance of Request for Bid	
8.	Georgia Utility Contractor's License (if applicable)	
9.	Georgia General Contractors License (if applicable)	
10.	Georgia Professional License (if applicable)	
11.	Certificate Regarding Debarment	
12.	Disclosure Form and Questionnaire	
13.	Office of Contract Compliance Requirements (submitted in a separate envelope)	
14.	Proof of Insurance Coverage	

END OF SECTION

BID FORM

Submitted To: Fulton County Government

Submitted By: _____

For:

Submitted on _____, 2013.

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Bid as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this Bid or in the Contract to be entered into; that this Bid is made without connection with any other person, company or parties making a Bid; and that it is in all respects fair and in good faith without collusion or fraud.

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Drawings and Specifications for the work and contractual documents relative thereto, and has read all instructions to Bidders and General Conditions furnished prior to the openings of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this Bid is accepted, to contract with the Board of Commissioners of Fulton County, Atlanta, Georgia, in the form of contact specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary, and to complete the construction of the work in full and complete accordance with the shown, noted, and reasonably intended requirements of the Specifications and Contract Documents to the full and entire satisfaction of the Board of Commissioners of Fulton County, Atlanta, Georgia, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents for the following prices.

THE BASE BID IS THE AMOUNT UPON WHICH THE BIDDER WILL BE FORMALLY EVALUATED AND WHICH WILL BE USED TO DETERMINE THE LOWEST RESPONSIBLE BIDDER.

The base bid may not be withdrawn or modified for a period of sixty (60) days following the receipt of bids.

BASE BID AMOUNT (ITEMS 1 THROUGH 2 (BELOW) INCLUSIVE):

$_____
(Dollar Amount In Numbers)

_____
(Dollar Amount in Words)

The Bidder agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written “Notice to Proceed” from the County.

The Bidder declares that he understands that the quantities shown for the unit prices items are subject to either increase or decrease, and that should the quantities of any of the items of work be increased, the Bidder proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, the Bidder also understands that payment will be made on the basis of actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in quantities; and that actual quantities will be determined upon completion of work, at which time adjustments will be made to the contract amount by direct increase or decrease.

ITEM 1

Furnishing all products, materials and equipment and performing all labor necessary to complete and put into operation the Sullivan Wastewater Pump Stations Improvements, including all work shown on the Drawings and/or Specified, and not included in Item 2 below, the amount
of:

DOLLARS ($).

ITEM 2 - ALLOWANCES

a.	Owner Directed Allowance	$50,000
b.	Soils, Concrete, Asphalt and Materials Testing	$10,000
c.	Unforeseen Conditions	$10,000
d.	Utility Conflict Resolution	$10,000
e.	Landscape Allowance	$20,000
f.	Roof Repair Allowance	$100,000

BID DATA

The Bidder shall designate below the one manufacturer for each product to be furnished and installed if awarded the Work.

1. Product: Dry-Pit Submersible Wastewater Pumps
   Manufacturer:_____

2. Product: Diesel Generators
   Manufacturer:_____

3. Product: Motor Control Centers
   Manufacturer:_____

4. Product: Flow Meters
   Manufacturer:_____

5. Product: Variable Frequency Drives
   Manufacturer:_____

The Bidder furthermore agrees that, in the case of a failure on his part to execute the Contract Agreement and Bonds within ten days after receipt of conformed contract documents for execution, the Bid Bond accompanying his bid and the monies payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure.

Enclosed is a Bid Bond in the approved form, in the sum of:

_____Dollars

($_____) according to the conditions of “Instructions to Bidders” and provisions thereof.

The undersigned acknowledges receipt of the following addenda (list by the number and date appearing on each addendum) and thereby affirms that its Bid considers and incorporates any modifications to the originally issued Bidding Documents included therein.

ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____

BIDDER: _____

Signed by: _____
[Type or Print Name]

Title: _____

Business Address: _____

_____

_____

Business Phone: _____

Note: If the Bidder is a corporation, the Bid shall be signed by an officer of the corporation; if a partnership, it shall be signed by a partner. If signed by others, authority for signature shall be attached.

The full name and addresses of persons or parties interested in the foregoing Bid, as principals, are as follows:

Name	**Address**

END OF SECTION

SECTION 3

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

SECTION 01 10 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF WORK

A. The work under this Contract is located at the Sullivan Wastewater Pump Stations #1 through #4, located in Sandy Springs, Georgia. All of these facilities are owned by the Fulton County Water Resources Department.

1. Sullivan Wastewater Pump Station #1 is located at 8345 Grogans Ferry Road, Sandy Springs, Georgia.

2. Sullivan Wastewater Pump Station #2 is located at 155 Grogans Landing, Sandy Springs, Georgia.

3. Sullivan Wastewater Pump Station #3 is located at 2700 Harbor Pointe Parkway, Sandy Springs, Georgia.

4. Sullivan Wastewater Pump Station #4 is located at 2300 Spring Creek Lane, Sandy Springs, Georgia.

1.2 GENERAL SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals necessary to perform the Work, upgrade the pumps stations and make them ready for operation as shown on the Drawings and specified herein.

B. Major areas of the Work include, but are not necessarily limited to, the following items:

1. Prepare the Sullivan Wastewater Pump Stations sites for use including:

a. Construction of access roadway to the site.

b. Removal and replacement of existing dry pit submersible pumps, piping and related appurtenances

c. Upgrade of electrical power system.

d. Implementation of odor control system.

e. Establish and install erosion and sediment control.

f. Replacement of the existing diesel backup generator with new generator.

g. Installation of a new bypass and flow meter system.

2. Site demobilization and site restoration, as required.

1.3 SCOPE OF WORK FOR PUMPING STATIONS

A. The Work includes, but is not necessarily limited to, the following major items:
   1. Removal and replacement of existing dry pit submersible pumps, piping and related appurtenances.
   2. Electrical, instrumentation and controls wiring.
   3. Installation of emergency bypass pumping system.
   4. Restoration and revegetation of the site.

B. Special considerations:

   1. The Contractor shall ensure that necessary precautions are taken to maintain functionality and operation of pump station(s) during construction.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
2. Limits: Confine construction operations to areas of work shown in Plans.
3. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
4. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
5. Owner Occupancy: Allow for Owner occupancy of Project site.
6. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
7. Schedule deliveries to minimize use of driveways and entrances by construction operations.
8. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
9. Do not unreasonably encumber site with equipment, materials, or vehicles.
10. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed, to conditions which existed previous to starting performance under the Contract.
11. Parking for construction personnel including the use of Owner’s site(s) shall be reviewed with Owner before construction start.

12. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
13. Limit use and operation within existing facilities to areas indicated for construction work and as required to perform Work. Other areas within facility shall not be disturbed or disrupted.
14. Perform Work so as not to interfere or inconvenience staff and Owner’s operation.
15. Maintain and keep clear all required fire exit ways throughout facility within and in vicinity of construction areas. Coordinate alternate temporary egress routes with Owner and local fire authority.
16. Do not load structure with weights that will endanger structure.
17. Smoking is absolutely prohibited within facilities or on Owner’s property.
18. Audio devices and radios are prohibited; except that two-way radios, and their use within occupied facilities shall be limited so not to disrupt occupants.
19. T-shirts or other clothing with derogatory depictions, language, and/or slogans regarding alcohol, drugs, race or sexual in nature, shall not be worn on premises.

20. Derogatory language regarding race, sexual or religious in nature, shall not be used on premises.
21. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
22. Make every effort to keep noise to a minimum in construction operation. Jackhammers shall not be permitted for use within the existing building without the Owner's consent.

1.5 COORDINATION WITH OPERATIONS STAFF AND CONTRACTOR

A. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
C. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
D. Contractor and his forces shall exercise special care during all aspects of construction activity including material deliveries, hoisting and installation activities.
E. Control of traffic, dust, dirt, and construction related noise shall be maintained at all times.
F. Schedule work at such time and in such a manner so as to minimize interference and inconvenience to staff and Owner's operations.
G. Each Contractor must obtain authorization of General Contractor as approved by Owner, before starting any work within an existing area of building.
H. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.
I. Work shall be performed in a manner that will not impose avoidable hardship, danger, or inconvenience to staff.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

   2. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
      a. Notify Engineer and Owner not less than two days in advance of proposed utility interruptions.
      b. Obtain Owner's written permission before proceeding with utility interruptions.

   3. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   4. Notify Engineer and Owner not less than two days in advance of proposed disruptive operations.
   5. Obtain Owner's written permission before proceeding with disruptive operations.

   6. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

   7. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

   8. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

9. Maintain list of approved screened personnel with Owner's representative.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Project Manual: The Project Manual comprises written documents for the Work that include Specifications issued under the professional seals of the Engineer and its consultants, and documents prepared by the Owner or other entities for which the Engineer has no responsibility. The Project Manual may contain documents such as bidding requirements and information available to bidders that are not Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
Specification requirements are to be performed by Contractor unless specifically stated otherwise.

1. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

2. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

3. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

4. Abbreviations: Materials and products are identified by industry standard abbreviations and as scheduled on Drawings.

1.8 MISCELLANEOUS PROVISIONS

A. By execution of this Contract, Contractor acknowledges review of proposed details and specifications and agrees to provide warranties and bonds for products and systems specified herein, detailed on drawings and as approved as a substituted or comparable product or system in accordance with Division 01 Section "Product Requirements".

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

BID BOND

No bid for a contract in Fulton County for work to be done shall be valid for any purpose unless the Contractor shall give a Bid Bond with good and sufficient surety payable to, in favor of, and for the protection of Fulton County. The Bid Bond shall not be less than 5% of the total amount payable by the terms of the Contract. No bid shall be read aloud or considered if a proper bid bond has not been submitted.

Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal.

BID BOND

S126 SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS

FULTON COUNTY GOVERNMENT

KNOW ALL MEN BY THESE PRESENTS, THAT WE_____

_____

hereinafter called the PRINCIPAL, and _____

_____

hereinafter call the SURETY, a corporation chartered and existing under the laws of the State of _____and duly authorized to transact Surety business in the State of Georgia, are held and firmly bound unto the Fulton County Government (COUNTY), in the penal sum of _____ _____Dollars and Cents ($_____ _____) good and lawful money of the United States of America, to be paid upon demand of the COUNTY, to which payment well and truly to be made we bind ourselves, our heirs, executors, and administrators and assigns, jointly and severally and firmly by these presents.

WHEREAS the PRINCIPAL has submitted to the COUNTY, for S126 SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS, a Bid;

WHEREAS the PRINCIPAL desires to file this Bond in accordance with law:

NOW THEREFORE: The conditions of this obligation are such that if the Bid be accepted, the PRINCIPAL shall within ten (10) calendar days after receipt of written notification from the COUNTY of the award of the Contract execute the Contract in accordance with the Bid and upon the terms, conditions and prices set forth therein, in the form and manner required by the COUNTY, and execute sufficient and satisfactory Performance and Payments Bonds payable to the COUNTY, each in the amount of one hundred percent (100%) of the total contract price, in form and with security satisfactory to said COUNTY, then this obligation to be void; otherwise, to be and remain in full force and virtue in law; and the SURETY shall upon failure of the PRINCIPAL to comply with any or all of the foregoing requirements within the time specified above immediately pay to the COUNTY, upon demand the amount hereof in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

In the event suit is brought upon this Bond by the COUNTY and judgment is recovered, the SURETY shall pay all costs incurred by the COUNTY in such suit, including attorney's fees to be fixed by the Court.

Enclosed is a Bid Bond in the approved form, in the amount of _____ _____Dollars ($_____) being in the amount of five percent (5%) of the Contract Sum. The money payable on this bond shall be paid to the COUNTY, for the failure of the Bidder to execute a Contract within ten (10) days after receipt of the Contract and at the same time furnish a Payment Bond and Performance Bond.

(SIGNATURES ON NEXT PAGE)

IN TESTIMONY THEREOF, the PRINCIPAL and SURETY have caused these presents to be duly signed and sealed this _____day of _____, 20__

ATTEST:

_____
PRINCIPAL

_____ BY_____

(SEAL)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as principal in the within bond; that _____, who signed the said bond of said corporation; that I know this signature, and his/her signature thereto is genuine; and that said bond was duly signed, sealed and attested for in behalf of said Corporation by authority of its governing body.

_____
SECRETARY

(CORPORATE SEAL)

_____
SURETY

_____ BY_____
(SEAL)

END OF SECTION

PAYMENT BOND

No Contract with Fulton County for work to be done shall be valid for any purpose unless the Contractor provides a Payment Bond with good and sufficient surety payable to Fulton County for the use and protection of all sub-contractors and all persons supplying labor, materials, machinery, and equipment in the prosecution of the work provided for in the Contract. The Payment Bond shall be in the amount of 100% of the total contract amount, payable by the terms of the Contract, and shall be written on the following form.

Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal**.**

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that _____
(Insert name of Contractor)
(hereinafter called the "Principal") and _____(hereinafter called the
(Insert name of Surety)
"Surety"), are held and firmly bound unto **FULTON COUNTY**, a political subdivision of the State of Georgia (hereinafter called the "Owner"), its successors and assigns as obligee, in the penal sum of _____*[100% of Contract amount]*, lawful money of the United States of America, for the payment of which the Principal and the Surety bind themselves, their administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered, or is about to enter, into a certain written contract with the Owner, dated _____, which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services of a project known as **S126 SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS**, as more particularly described in the Contract (hereinafter called the "Project");

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to all persons working on or supplying labor or materials under the Contract, and any amendments thereto, with regard to labor or materials furnished and used in the Project, and with regard to labor or materials furnished but not so used, then this obligation shall be void; but otherwise it shall remain in full force and effect.

1. A "Claimant' shall be defined herein as any subcontractor, person, party, partnership, corporation or the entity furnishing labor, services or materials used, or reasonably required for use, in the performance of the Contract, without regard to whether such labor, services or materials were sold, leased or rented, and without regard to whether such Claimant is or is not in privity of contract with the Principal or any subcontractor performing work on the Project, including, but not limited to, the following labor, services, or materials: water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. In the event a Claimant files a lien against the property of the Owner, and the Principal fails or refuses to satisfy or remove it promptly, the Surety shall satisfy or remove the lien promptly upon written notice from the Owner, either by bond or as otherwise provided in the Contract.

3. The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in the payment terms, and any other amendments in or about the Contract and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and amendments.

4. The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment or modifications to the Contract, so as to bind the Principal and Surety, jointly and severally, to the full payment of any Claimant under the Contract, as amended or modified, provided only that the Surety shall not be liable for more than the penal sum of the Bond, as specified in the first paragraph hereof.

5. This Bond is made for the use and benefit of all persons, firms, and corporations who or which may furnish any materials or perform any labor for or on account of the construction-type services to be performed or supplied under the Contract, and any amendments thereto, and they and each of them may sue hereon.

6. No action may be maintained on this Bond after one (1) year from the date the last services, labor, or materials were provided under the Contract by the Claimant prosecuting said action.

7. This Bond is intended to comply with O.C.G.A. Section 13-10-1, and shall be interpreted so as to comply with the minimum requirements thereof. However, in the event the express language of this Bond extends protection to the Owner beyond that contemplated by O.C.G.A. Section 13-10-1, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

IN WITNESS WHEREOF the undersigned have caused this instrument to be executed and their respective corporate seals to be affixed and attested by their duly authorized representatives this day of _____, _____.

_____(SEAL)
(Principal)

By:_____

Attest:

_____
Secretary

_____(SEAL)
(Surety)

By:_____

Attest:

_____
Secretary

_____

(Address of Surety's Home Office)

_____
(Resident Agent of Surety)

END OF SECTION

PERFORMANCE BOND

No contract with Fulton County for work to be done shall be valid for any purpose unless the Contractor provides a Performance Bond with good and sufficient surety payable to, in favor of, and for the protection of Fulton County. The Performance Bond shall be in the amount of 100% of the total contract amount, payable by the terms of the Contract, and shall be written on the following form.

Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business as a surety in Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that _____
(Insert name of Contractor)
(hereinafter called the "Principal") and _____(hereinafter called the
(Insert name of Surety)
"Surety"), are held and firmly bound unto **FULTON COUNTY**, a political subdivision of the State of Georgia (hereinafter called the "Owner"), its successors and assigns, in the penal sum of _____*[100% of Contract amount]*, lawful money of the United States of America, for the payment of which the Principal and the Surety bind themselves, their administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered, or is about to enter, into a certain written contract with the Owner, dated _____, which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services of a project known as **S126 SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS**, as more particularly described in the Contract (hereinafter called the "Project");

NOW, THEREFORE, the conditions of this obligation are as follows, that if the Principal shall fully and completely perform all the undertakings, covenants, terms, conditions, warranties, and guarantees contained in the Contract, including all modifications, amendments, changes, deletions, additions, and alterations thereto that may hereafter be made, then this obligation shall be void; otherwise it shall remain in full force and effect.

Whenever the Principal shall be, and declared by the Owner to be, in default under the Construction-Type Contract, the Surety shall promptly remedy the default as follows:

1. Complete the Contract in accordance with its terms and conditions; or, at the sole option of the Owner,

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the Surety and the Owner of the lowest responsible bidder, arrange for a contract between such bidder and Owner and make available as the work progresses (even though there should be a default or succession of defaults under the Contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the penal sum set forth in the first paragraph hereof, as may be adjusted, and the Surety shall make available and pay to the Owner the funds required by this Paragraph prior to the payment of the Owner of the balance of the contract price, or any portion thereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Owner to the Contractor under the Contract, and any amendments thereto, less the amount paid by the Owner to the Contractor; or, at the sole option of the Owner,

3. Allow Owner to complete the work and reimburse the Owner for all reasonable costs incurred in completing the work.

In addition to performing as required in the above paragraphs, the Surety shall indemnify and hold harmless the Owner from any and all losses, liability and damages, claims, judgments, liens, costs and fees of every description, including reasonable attorney's fees, litigation costs and expert witness fees, which the Owner may incur, sustain or suffer by reason of the failure or default on the part of the Principal in the performance of any or all of the terms, provisions, and requirements of the Contract, including any and all amendments and modifications thereto, or incurred by the Owner in making good any such failure of performance on the part of the Principal.

The Surety shall commence performance of its obligations and undertakings under this Bond promptly and without delay, after written notice from the Owner to the Surety.

The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and any other amendments in or about the Contract, and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, change in payment terms, and amendments.

The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment to the Contract, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended or modified, and so as to increase the penal sum to the adjusted Contract Price of the Contract.

No right of action shall accrue on this Bond to or for the use of any person, entity or corporation other than the Owner and any other obligee named herein, or their executors, administrators, successors or assigns.

This Bond is intended to comply with O.C.G.A. Section 36-91-1 et seq., and shall be interpreted so; as to comply with; the minimum requirements thereof. However, in the event the express language of this Bond extends protection to; the Owner beyond that contemplated by O.C.G.A. Section 36-91-1 et seq. and O.C.G.A. Section 13-10-1, as amended, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

IN WITNESS WHEREOF the undersigned have caused this instrument to be executed and their respective corporate seals to be affixed and attested by their duly authorized representatives this day of _____, _____.

_____(SEAL)
(Principal)

By:_____

Attest:

_____
Secretary

_____(SEAL)
(Surety)

By:_____

Attest:

_____
Secretary

_____

(Address of Surety's Home Office)

_____
(Resident Agent of Surety)

END OF SECTION

SECTION 5
INSURANCE AND RISK MANAGEMENT PROVISIONS
CONSTRUCTION - SULLIVAN WASTEWATER PUMP STATIONS IMPROVEMENTS

It is Fulton County Government's practice to obtain Certificates of Insurance from our Contractors and Vendors. Insurance must be written by a licensed agent in a company licensed to write insurance in the State of Georgia, with an A.M. Best rating of at least A- VI, subject to final approval by Fulton County. Respondents shall submit with the bid/proposal evidence of insurability satisfactory to Fulton County Government as to form and content. Either of the following forms of evidence is acceptable:

A letter from an insurance carrier stating that upon your firm/company being the successful Bidder/Respondent that a Certificate of Insurance shall be issued in compliance with the Insurance and Risk Management Provisions outlined below.

A Certificate of Insurance complying with the Insurance and Risk Management Provisions outlined below (Request for Bid/Proposal number and Project Name, Number and Description must appear on the Certificate of Insurance).

A combination of specific policies written with an umbrella policy covering liabilities in excess of the required limits is acceptable to achieve the applicable insurance coverage levels.

Upon award, the Contractor/Vendor must maintain at their expense, insurance with policy limits equal to or greater than the limits described below. Proof of insurance must be provided to Fulton County Government prior to the start of any activities/construction as described in the bid document(s). Any and all Insurance Coverage(s) and Bonds required under the terms and conditions of the contract shall be maintained during the entire length of the contract, including any extensions or renewals thereto, and until all work has been completed to the satisfaction of Fulton County Government.

Accordingly the Respondent shall provide a certificate evidencing the following:

1. WORKERS COMPENSATION/EMPLOYER'S LIABILITY INSURANCE – STATUTORY (In compliance with the Georgia Workers Compensation Acts and any other State or Federal Acts or Provisions in which jurisdiction may be granted)

Employer's Liability Insurance	BY ACCIDENT	EACH ACCIDENT	$1,000,000
Employer's Liability Insurance	BY DISEASE	POLICY LIMIT	$1,000,000
Employer's Liability Insurance	BY DISEASE	EACH EMPLOYEE	$1,000,000

2. COMMERCIAL GENERAL LIABILITY INSURANCE (Including contractual Liability Insurance)

Bodily Injury and Property Damage Liability	Each Occurrence	$1,000,000
(Other than Products/Completed Operations)	General Aggregate	$2,000,000
Products\Completed Operation	Aggregate Limit	$2,000,000
Personal and Advertising Injury	Limits	$1,000,000
Damage to Rented Premises	Limits	$100,000

3. BUSINESS AUTOMOBILE LIABILITY INSURANCE

Combined Single Limits	Each Occurrence	$1,000,000

(Including operation of non-owned, owned, and hired automobiles).
Broadened Pollution Endorsement CA9948 and MCS 90

4. UMBRELLA LIABILITY

(In excess of above noted coverages)	Per Occurrence/Aggregate	$2,000,000/$2,000,000

Certificates of Insurance

Certificates shall state that the policy or policies shall not expire, be cancelled or altered without at least thirty (30) days prior written notice to Fulton County Government. Policies and Certificates of Insurance are to list Fulton County Government as an Additional Insured (except for Workers' Compensation) and shall conform to all terms and conditions (including coverage of the indemnification and hold harmless agreement) contained in the Insurance and Risk Management Provisions. The General Liability Additional Insured language should apply to on-going and completed-operations, using ISO form CG 2010 (11/85 version) or equivalent.

If Fulton County Government shall so request, the Respondent, Contractor or Vendor will furnish the County for its inspection and approval such policies of insurance with all endorsements, or confirmed specimens thereof certified by the insurance company to be true and correct copies.

The Contractor agrees to name the Owner and all other parties required of the Contractor/Vendor shall be included as additional insureds on the CGL, using ISO Additional Insured Endorsement forms CG 2010 11/85 or its equivalent coverage to the additional insureds. This insurance for the additional insureds shall be as broad as the coverage provided for the named insured Subcontractor. It shall apply as Primary Insurance before any other insurance or self-insurance, including any deductible, non-contributory, and Waiver of Subrogation provided in favor of Fulton County.

Additional Insured under the General Liability, Auto Liability, Umbrella Policies (with exception of Workers Compensation and Professional Liability), with no Cross Suits exclusion.

Important:
It is understood that **Insurance in no way Limits the Liability of the Contractor/Vendor.**

USE OF PREMISES

Contractor/Vendor shall confine its apparatus, the storage of materials and the operations of its workers to limits/requirements indicated by law, ordinance, permits and any restrictions of Fulton County Government and shall not unreasonably encumber the premises with its materials.

PROTECTION OF PROPERTY

Contractor/Vendor will adequately protect its own work from damage, will protect Fulton County Government's property from damage or loss and will take all necessary precautions during the progress of the work to protect all persons and the property of others from damage or loss.

Contractor/Vendor shall take all necessary precautions for the safety of employees of the work and shall comply with all applicable provisions of the Federal, State and local safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where work is being performed.

Contractor/Vendor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of its employees, Fulton County Government employees and the public and shall post all applicable signage and other warning devices to protect against potential hazards for the work being performed.

INDEMNIFICATION AND HOLD HARMLESS AGREEMENT

To the fullest extent of the Law, Contractor/Vendor hereby agrees to release, indemnify, defend and hold harmless Fulton County, its Commissioners, officers, employees, subcontractors, successors, assigns and agents, from and against any and all losses (including death), claims, damages, liabilities, costs and expenses (including but not limited to all actions, proceedings, or investigations in respect thereof and any costs of judgments, settlements, court costs, attorney's fees or expenses, regardless of the outcome of any such action, proceeding, or investigation), caused by, relating to, based upon or arising out of any act or omission by Contractor/Vendor, its directors, officers, employees, subcontractors, successors, assigns or agents, or otherwise in connection (directly or indirectly) with its acceptance, or the performance, or nonperformance, of its obligations under these agreements. Such obligations shall not be construed to negate, abridge or otherwise reduce any other rights or obligations of indemnity which would otherwise exist as to any party or person as set forth in this paragraph.

Contractor/Vendor further agrees to protect, defend, indemnify and hold harmless Fulton County, its Commissioners, officers, employees, subcontractors, successors, assigns and agents from and against any and all claims or liability for compensation under the Worker's Compensation Act, Disability Benefits Act, or any other employee benefits act arising out of injuries sustained by any employees of Contractor/Vendor. These indemnities shall not be limited by reason of the listing of any insurance coverage.

FULTON COUNTY ACKNOWLEDGES THAT ALL PROVISIONS OF THIS INDEMNITY AGREEMENT MAY NOT BE APPLICABLE TO THE CONTRACTOR/VENDOR'S BUSINESS. TO THE EXTENT THAT CONTRACTOR/VENDOR MAY DEMONSTRATE SUCH NONAPPLICABILITY, FULTON COUNTY MAY NEGOTIATE AMENDMENTS TO THIS AGREEMENT AS THE CIRCUMSTANCES DICTATE.

CONTRACTOR/VENDOR ACKNOWLEDGES HAVING READ, UNDERSTANDING, AND AGREEING TO COMPLY WITH THIS INDEMNIFICATION AND HOLD HARMLESS AGREEMENT, AND THE REPRESENTATIVE OF THE CONTRACTOR/VENDOR IDENTIFIED BELOW IS AUTHORIZED TO SIGN CONTRACTS ON BEHALF OF THE RESPONDING CONTRACTOR/VENDOR.

COMPANY: _____ SIGNATURE: _____

NAME: _____TITLE: _____

DATE: _____

END OF SECTION

PURCHASING FORMS & INSTRUCTIONS

This section contains the procurement forms that are required to be executed and submitted with the bid package. This section does not contain all forms required to be included with the bid package submittal.

To be deemed responsive to this ITB, Bidders must provide the information requested and complete in detail all Purchasing Forms. The appropriate individual(s) authorized to commit the Bidder to the Project must sign the Purchasing Forms. Bidders should reproduce each Purchasing Form, as required, and complete the appropriate portions of the forms provided in this section.

- Form A: Non-Collusion Affidavit of Prime Bidder/Offeror
- Form B: Certificate of Acceptance of Request for Bid/Proposal Requirements
- Form C: Professional License Certifications ***(not applicable)***
    - Form C1 – Georgia Utility License Contractor License
    - Form C2 – Georgia General Contractors License
    - Form C3 – Georgia Professional License
- Form D: Certification Regarding Debarment
- Form E: Disclosure Form and Questionnaire
- Form F: Georgia Security and Immigration Contractor Affidavit and Agreement
- Form G: Georgia Security and Immigration Subcontractor Affidavit

FORM A: NON-COLLUSION AFFIDAVIT OF BIDDER/OFFEROR

STATE OF GEORGIA

COUNTY OF FULTON

I, _____ certify that pursuant to Fulton County Code Section 2-320 (11), this bid or proposal is made without prior understanding, agreement or connection with any corporation, firm or person submitting a bid for the same work, labor or service to be done or the supplies, materials or equipment to be furnished and is in all respects fair and without collusion or fraud. I understand collusive bidding is a violation of state and federal law and can result in fines, prison sentences and civil damages awards. I agree to abide by all conditions of this bid or proposal and certify that I am authorized to sign this bid or proposal for the bidder.

Affiant further states that pursuant to O.C.G.A. Section 36-91-21 (d) and (e), _____ has not, by itself or with others, directly or indirectly, prevented or attempted to prevent competition in such bidding or proposals by any means whatsoever. Affiant further states that (s)he has not prevented or endeavored to prevent anyone from making a bid or offer on the project by any means whatever, nor has Affiant caused or induced another to withdraw a bid or offer for the work.

Affiant further states that the said offer of _____ is bona fide, and that no one has gone to any supplier and attempted to get such person or company to furnish the materials to the bidder only, or if furnished to any other bidder, that the material shall be at a higher price.

_____
(COMPANY NAME)

_____
(PRESIDENT/VICE PRESIDENT)

Sworn to and subscribed before me this _____ day of _____, 20__.

_____
(SECRETARY/ASSISTANT SECRETARY)

(Affix corporate seal here, if a corporation)

Notary Public: _____

County: _____

Commission Expires: _____

NOTE:

IF THE OFFEROR IS A PARTNERSHIP, ALL OF THE PARTNERS AND ANY OFFICER, AGENT, OR OTHER PERSON WHO MAY HAVE REPRESENTED OR ACTED FOR THEM IN BIDDING FOR OR PROCURING THE CONTRACT SHALL ALSO MAKE THIS OATH.

IF THE OFFEROR IS A CORPORATION, ALL OFFICERS, AGENTS, OR OTHER PERSONS WHO MAY HAVE ACTED FOR OR REPRESENTED THE CORPORATION IN BIDDING FOR OR PROCURING THE CONTRACT SHALL MAKE THE OATH.

FORM B: FULTON COUNTY CERTIFICATE OF ACCEPTANCE OF BID/PROPOSAL REQUIREMENTS

This is to certify that on this day, offeror acknowledges that he/she has read this solicitation document, pages #_____ to #_____ inclusive, including any addenda # to #_____ exhibit(s) #____ to #_____, attachment(s) #_____ to #_____, and/or appendices #_____ to #,_____in its entirety, and agrees that no pages or parts of the document have been omitted, that he/she understands, accepts and agrees to fully comply with the requirements therein, and that the undersigned is authorized by the offeror to submit the proposal herein and to legally obligate the offeror thereto.

This is also to certify that the offeror has reviewed the form Fulton County contract included in the solicitation documents and agrees to be bound by its terms, or that the offeror certifies that it is submitting any proposed modification to the contract terms with its proposal. The offeror further certifies that the failure to submit proposed modifications with the proposal waives the offeror's right to submit proposed modifications later. The offeror also acknowledges that the indemnification and insurance provisions of Fulton County's contract included in the solicitation documents are non-negotiable and that proposed modifications to said terms may be reason to declare the offeror's proposal as non-responsive.

Company: _____

Signature: _____

Name: _____

Title: _____

Date: _____

(Corporate Seal)

FORM C1: CONTRACTOR'S GEORGIA UTILITY LICENSE CERTIFICATION

Contractor's Name: _____

Utility Contractor's Name: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed:
_____

Date: _____

(ATTACH COPY OF LICENSE)

FORM C2: CONTRACTOR'S GEORGIA GENERAL CONTRACTOR'S LICENSE CERTIFICATION

Contractor's Name: _____

General Contractor's License Number: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed: _____

Date: _____

(ATTACH COPY OF LICENSE)

FORM C3: GEORGIA PROFESSIONAL LICENSE CERTIFICATION

NOTE: Please complete this form for the work your firm will perform on this project.

Contractor's Name: _____

Performing work as: Prime Contractor ____ Sub-Contractor _____

Professional License Type: _____

Professional License Number: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed: _____

Date: _____

(ATTACH COPY OF LICENSE)

FORM D: CERTIFICATION REGARDING DEBARMENT

(1) The Offeror certifies that neither it or its subcontractors is presently debarred, suspended, proposed for debarment, declared ineligible, or otherwise excluded from doing business with any government agency. Any such exclusion may cause prohibition of your firm from participating in any procurement by the Fulton County Government.

(2) If the Offeror is unable to certify to any of the statements in this certification, such Offeror or subcontractor shall attach an explanation to this bid or proposal.

INSTRUCTIONS FOR CERTIFICATION

By signing and submitting this certification, the Offeror is providing the certification set out below:

(1) The certification in this clause is a material representation of fact upon which reliance will be placed. If it is later determined that the prospective vendor knowingly rendered a false certification, the Purchasing Agent may pursue all available remedies, including suspension and/or debarment, for withdrawal of award or termination of a contract.

(2) The prospective Offeror shall provide immediate written notice to the Purchasing Agent if at anytime the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(3) Offeror shall be under a continuing duty to immediately inform the Purchasing Agent in writing of any changes, if as a result of such changes, the Offeror certification regarding debarment is affected.

DEBARMENT ORDINANCE

The following Section 2-322 of Fulton County Code of Laws establishes the procedure for the debarment of contractors.

(a) ***Authority to suspend.***

After reasonable notice to the entity involved and reasonable opportunity for that entity to be heard, the Purchasing Agent, after consultation with user department, the County Manager and the County Attorney shall have the authority to suspend an entity for cause from consideration for award of county contracts. As used in this section, the term entity means any business entity, individual, firm, contractor, subcontractor or business corporation, partnership, limited liability corporation, firm, contractor, subcontractor or business structured; provided, further, that any such entity shall also be subject to suspension under this section if any of its constituents, members, subcontractors at any tier of such entity's and the entity, or any constituent or member, knew or should have known of the commission of the act. The suspension shall be for a period not to exceed three (3) years unless cause is based on a felony conviction for an offense related or associated with fraudulent contracting or misappropriation of funds wherein the suspension shall not exceed seven (7) years.

(b) ***Causes for Suspension. The causes for suspension include:***

(1) Conviction for commission of a criminal offense as an incident to obtain or attempting to obtain a public or private contract or subcontract, or in performance of such contract or subcontract;

(2) Conviction of state or federal statutes of embezzlement, theft, forgery, bribery, falsification or destruction of records, receiving stolen property or other offense indicating a lack of business integrity or business honesty which currently, seriously and directly affects responsibility as a county contractor.

(3) Conviction of state or federal anti-trust statues arising out of the solicitation and submission of bids and proposals;

(4) Violation of contract provisions, as set forth below, of a character which is regarded by the Purchasing Agent to be so serious as to justify suspension action:

a. Failure to perform in accordance with the specifications within a time limit provided in a county contract;

b. A recent record of failure to perform or unsatisfactory performance in accordance with the terms of one or more contracts; provided, that failure to perform or unsatisfactory performance caused by acts beyond the control of the contractor shall not be considered to be a basis for suspension;

c. Material representation of the composition of the ownership or workforce or business entity certified to the county as a minority business enterprise; or

d. Falsification of any documents.

(5) For violation of the ethical standards set forth in Fulton County Code Chapter 9, Code of Ethics.

(6) Knowing misrepresentation to the county, of the use which a majority owned contractor intends to make a minority business enterprise (a business entity at least 51 percent of which is owned and controlled by minority persons, as defined in Fulton County Code Chapter 6, Article B, Minority Business Enterprise Affirmative Action Program and certified as such by the County) as a subcontractor or a joint venture partner, in performing work under contract with the County.

Failure to fully and truthfully provide the information required, may result in the disqualification of your bid/proposal from consideration or termination of the Contract, once awarded. This document must be completed and included as a part of the bid/proposal package along with other required documents.

[SIGNATURES ON NEXT PAGE]

Under penalty of perjury, I declare that I have examined this certification and all attachments hereto, if applicable, to the best of my knowledge and belief, and all statements contained hereto are true, correct, and complete.

On this _____ day of _____, 20____

_____

Legal Name of Offeror) (Date)

_____

(Signature of Authorized Representative) (Date)

_____

(Title)

FORM E: DISCLOSURE FORM AND QUESTIONNAIRE

1. Please provide the names and business addresses of each of the Offeror's firm's officers and directors.

   For the purposes of this form, the term "Offeror" means an entity that responds to a solicitation for a County contract by either submitting a proposal in response to a Request for Proposal or a Request for Qualification or a Bid in response to an Invitation to Bid. Describe accurately, fully and completely, their respective relationships with said Offeror, including their ownership interests and their anticipated role in the management and operations of said Offeror.

2. Please describe the general development of said Offeror's business during the past five (5) years, or such shorter period of time that said Offeror has been in business.

3. Please state whether any employee, agent or representative of said Offeror who is or will be directly involved in the subject project has or has ever: (i) directly or indirectly had a business relationship with Fulton County; (ii) directly or indirectly received revenues from Fulton County; or (iii) directly or indirectly receives revenues from the result of conducting business on Fulton County property or pursuant to any contract with Fulton County. Please describe in detail any such relationship.

LITIGATION DISCLOSURE:

Failure to fully and truthfully disclose the information required, may result in the disqualification of your bid or proposal from consideration or termination of the Contract, once awarded.

1. Please state whether any of the following events have occurred in the last five (5) years with respect to said Offeror. If any answer is yes, explain fully the following:

   (a) whether a petition under the federal bankruptcy laws or state insolvency laws was filed by or against said Offeror, or a receiver fiscal agent or similar officer was appointed by a court for the business or property of said Offeror;

   Circle One: YES NO

   (b) whether Offeror was subject of any order, judgment, or decree not subsequently reversed, suspended or vacated by any court of competent jurisdiction, permanently enjoining said Offeror from engaging in any type of business practice, or otherwise eliminating any type of business practice; and

   Circle One: YES NO

   (c) whether said Offeror's business was the subject of any civil or criminal proceeding in which there was a final adjudication adverse to said or Offeror, which directly arose from activities conducted by the business unit or corporate division of said Offeror which submitted a bid or proposal for the subject project. If so please explain.

   Circle One: YES NO

2. Have you or any member of your firm or team to be assigned to this engagement ever been indicted or convicted of a criminal offense within the last five (5) years?

   Circle One: YES NO

3. Have you or any member of your firm or team been terminated (for cause or otherwise) from any work being performed for Fulton County or any other Federal, State or Local Government?

   Circle One: YES NO

4. Have you or any member of your firm or team been involved in any claim or litigation adverse to Fulton County or any other federal, state or local government, or private entity during the last three (3) years?

   Circle One: YES NO

5. Has any offeror, member of offeror's team, or officer of any of them (with respect to any matter involving the business practices or activities of his or her employer), been notified within the five (5) years preceding the date of this offer that any of them are the target of a criminal investigation, grand jury investigation, or civil enforcement proceeding?

Circle One: YES NO

If you have answered "YES" to any of the above questions, please indicate the name(s) of the person(s), the nature, and the status and/or outcome of the information, indictment, conviction, termination, claim or litigation, the name of the court and the file or reference number of the case, as applicable. Any such information should be provided on a separate page, attached to this form and submitted with your proposal.

NOTE: If any response to any question set forth in this questionnaire has been disclosed in any other document, a response may be made by attaching a copy of such disclosure. (For example, said Offeror's most recent filings with the Securities and Exchange Commission ("SEC") may be provided if they are responsive to certain items within the questionnaire.) However, for purposes of clarity, Offeror should correlate its responses with the exhibits by identifying the exhibit and its relevant text.

Disclosures must specifically address, completely respond and comply with all information requested and fully answer all questions requested by Fulton County. Such disclosure must be submitted at the time of the bid or proposal submission and included as a part of the bid/proposal submitted for this project. Disclosure is required for Offerors, joint venture partners and first-tier subcontractors.

Failure to provide required disclosure, submit officially signed and notarized documents or respond to any and all information requested/required by Fulton County can result in the bid/proposal declared as non-responsive. This document must be completed and included as a part of the bid/proposal package along with other required documents.

[SIGNATURES ON NEXT PAGE]

Under penalty or\f perjury, I declare that I have examined this questionnaire and all attachments hereto, if applicable, to the best of my knowledge and belief, and all statements contained hereto are true, correct, and complete.

On this _____ day of _____, 20__

_____

(Legal Name of Proponent) (Date)

_____

(Signature of Authorized Representative) (Date)

_____

(Title)

Sworn to and subscribed before me,

This _____ day of _____ , 20___

_____

(Notary Public) (Seal)

Commission Expires _____

(Date)

FORM F: GEORGIA SECURITY AND IMMIGRATION CONTRACTOR AFFIDAVIT AND AGREEMENT

Instructions:

Contractors must attest to compliance with the requirements of O.C.G.A 13-10-91 and the Georgia Department of Labor Rule 300-10-01-.02 by executing the Contractor Affidavit provided.

STATE OF GEORGIA

COUNTY OF FULTON

FORM F: GEORGIA SECURITY AND IMMIGRATION CONTRACTOR AFFIDAVIT AND AGREEMENT

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with **[insert name of prime contractor]** _____ on behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program* [any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603], in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

The undersigned further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services to this contract with **Fulton County Government**, contractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A/ 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees to maintain records of such compliance and provide a copy of each such verification to the **Fulton County Government** at the time the subcontractor(s) is retained to perform such service.

_____
EEV/Basic Pilot Program* User Identification Number

_____
BY: Authorized Officer of Agent
(Insert Subcontract Name)

_____
Title of Authorized Officer or Agent of Subcontractor

_____
Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this _____ day of _____, 20__.

Notary Public: _____

County: _____

Commission Expires: _____

NOTE:

*** As of the effective date of O.C.G.A. 13-10-91, the applicable federal work authorization program is the "EEV/Basic Pilot Program" operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).**

FORM G: GEORGIA SECURITY AND IMMIGRATION SUBCONTRACTOR AFFIDAVIT

Instructions:

In the event that your company is awarded the contract for this project, and will be utilizing the services of any subcontractor(s) in connection with the physical performance of services pursuant to this contract, the following affidavit must be completed by such subcontractor(s). Your company must provide a copy of each such affidavit to Fulton County Government, Department of Purchasing & Contract Compliance with the proposal submittal.

All subcontractor affidavit(s) shall become a part of the contract and all subcontractor(s) affidavits shall be maintained by your company and available for inspection by Fulton County Government at any time during the term of the contract. All subcontractor(s) affidavit(s) shall become a part of any contractor/subcontractor agreement(s) entered into by your company.

STATE OF GEORGIA

COUNTY OF FULTON

FORM G: GEORGIA SECURITY AND IMMIGRATION SUBCONTRACTOR AFFIDAVIT

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with **[insert name of prime contractor]** _____behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program* [any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603], in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

_

_____

EEV/Basic Pilot Program* User Identification Number

_____

BY: Authorized Officer of Agent
(Insert Subcontract Name)

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this _____ day of _____, 20__.

Notary Public: _____

County: _____

Commission Expires: _____

NOTE:

*** As of the effective date of O.C.G.A. 13-10-91, the applicable federal work authorization program is the "EEV/Basic Pilot Program" operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).**

SECTION 7

CONTRACT COMPLIANCE REQUIREMENTS

NON-DISCRIMINATION IN PURCHASING AND CONTRACTING

It is the policy of Fulton County Government that discrimination against businesses by reason of the race, color, gender or national origin of the ownership of any such business is prohibited. Furthermore, it is the policy of the Board of Commissioners ("Board") that Fulton County and all vendors and contractors doing business with Fulton County shall provide to all businesses the opportunity to participate in contracting and procurement paid, in whole or in part, with monetary appropriations of the Board without regard to the race, color, gender or national origin of the ownership of any such business. Similarly, it is the policy of the Board that the contracting and procurement practices of Fulton County should not implicate Fulton County as either an active or passive participant in the discriminatory practices engaged in by private contractors or vendors seeking to obtain contracts with Fulton County.

Implementation of Equal Employment Opportunity (EEO) Policy

The County effectuates Equal Employment Opportunity thru Policy #800-8, Non-Discrimination in Contracting and Procurement. This policy considers racial and gender workforce availability. The availability of each workgroup is derived from the work force demographics set forth in the 2000 Census EEO file prepared by the United States Department of Commerce for the applicable labor pool normally utilized for the contract.

Monitoring of EEO Policy

Upon award of a contract with Fulton County, the successful bidder/proposer must complete an Equal Employment Opportunity Report (EEOR), describing the racial and gender make-up of the firm's work force. If the EEOR indicates that the firm's demographic composition indicates underutilization of employee's of a particular ethnic group for each job category, the firm will be required to submit an aggressive action plan setting forth steps the firm will take to address the identified underutilization.

DETERMINATION OF GOOD FAITH EFFORTS

During the course of the project, the Prime Contractor shall demonstrate that they have made all efforts reasonably possible to ensure that Minority and Female Business Enterprises (MFBE) have had a full and fair opportunity to compete and win subcontracts on this project. The Prime Contractor is required to include all outreach attempts that would demonstrate a "Good Faith Effort" in the solicitation of sub-consultants/subcontractors.

Written documentation demonstrating the Prime Contractor's outreach efforts to identify, contact, contract with or utilize Minority or Female owned businesses shall include holding pre-bid conferences, publishing advertisements in general circulation media, trade association publications, minority-focused media, and the County's bid board, as well as other efforts.

Include a list of publications where the advertisement was placed as well as a copy of the advertisement. Advertisement shall include at a minimum, scope of work, project location,

location(s) of where plans and specifications may be viewed or obtained and trade or scopes of work for which subcontracts are being solicited.

EQUAL BUSINESS OPPORTUNITY PLAN (EBO PLAN)

In addition to the proposal submission requirements, each vendor **must** submit an Equal Business Opportunity Plan (EBO Plan) with their bid/proposal. The EBO Plan is designed to enhance the utilization of a particular racial, gender or ethnic group by a bidder/proposer, contractor, or vendor or by Fulton County. The respondent **must** outline a plan of action to encourage and achieve diversity and equality in the available procurement and contracting opportunities with *this solicitation*.

The EBO Plan **must** identify and include:

1. Potential opportunities within the scope of work of *this solicitation* that will allow for participation of racial, gender or ethnic groups.

2. Efforts that will be made by the bidder/proposer to encourage and solicit minority and female business utilization in *this solicitation*.

Fulton County encourages joint ventures, teaming, partnering and mentor-protégé relationships with minority and female businesses in an effort to achieve contracting and procurement diversity.

Prompt Payment: The prime contractor **must** certify in writing and **must** document all subcontractors, sub-consultants and suppliers have been promptly paid for work and materials, (less any retainage by the prime contractor prior to receipt of any further progress payments). In the event the prime contractor is unable to pay subcontractors, sub-consultants or suppliers until it has received a progress payment from Fulton County, the prime contractor shall pay all subcontractors, sub-consultants or suppliers funds due from said progress payment within forty-eight (48) hours of receipt of payment from Fulton County. In no event shall a subcontractor, sub-consultant or supplier be paid later than fifteen (15) days as provided for by state law.

REQUIRED FORMS AND EBO PLAN

In order to be compliant with the intent and provisions of the Fulton County Non-Discrimination in Purchasing and Contracting Ordinance (99-0960), bidders/proposers **must** submit the following completed documents. Failure to provide this information **shall** result in the proposal being deemed non-responsive.

- Exhibit A – Promise of Non-Discrimination
- Exhibit B – Employment Report
- Exhibit C – Schedule of Intended Subcontractor Utilization
- Exhibit D – Letter of Intent to Perform as a Subcontractor or Provide Materials or Services
- Exhibit E – Declaration Regarding Subcontractors Practices
- Exhibit F – Joint Venture Disclosure Affidavit
- Equal Business Opportunity Plan (EBO Plan). This document is not a form rather a statement created by the bidder/proposer on its company letter head addressing the EBO Plan requirements.
- Exhibit H – First Source Jobs Program Information, Form 2

The following document must be completed as instructed if awarded the project:

- Exhibit G – Prime Contractor's Subcontractor Utilization Report
- Exhibit H – First Source Jobs Program Agreement, Form 3

All Contract Compliance documents (Exhibits A – H and EBO Plan) are to be placed in a **separate sealed envelope** clearly marked "Contract Compliance". The EBO Plan must be submitted on company letterhead. These documents are considered part of and should be submitted with the Technical Proposal.

EXHIBIT A – PROMISE OF NON-DISCRIMINATION

"Know all persons by these presents, that I/We (_____),
Name

_____ _____
Title Firm Name

Hereinafter "Company", in consideration of the privilege to bid on or obtain contracts funded, in whole or in part, by Fulton County, hereby consent, covenant and agree as follows:

1) No person shall be excluded from participation in, denied the benefit of, or otherwise discriminated against on the basis of race, color, national origin or gender in connection with any bid submitted to Fulton County for the performance of any resulting there from,

2) That it is and shall be the policy of this Company to provide equal opportunity to all businesses seeking to contract or otherwise interested in contracting with this Company without regard to the race, color, gender or national origin of the ownership of this business,

3) That the promises of non-discrimination as made and set forth herein shall be continuing in nature and shall remain in full force and effect without interruption,

4) That the promise of non-discrimination as made and set forth herein shall be made a part of, and incorporated by reference into, any contract or portion thereof which this Company may hereafter obtain,

5) That the failure of this Company to satisfactorily discharge any of the promises of non-discrimination as made and set forth herein shall constitute a material breach of contract entitling the Board to declare the contract in default and to exercise any and all applicable rights and remedies, including but not limited to cancellation of the contract, termination of the contract, suspension and debarment from future contracting opportunities, and withholding and/or forfeiture of compensation due and owning on a contract; and

6) That the bidder shall provide such information as may be required by the Director of Contract Compliance pursuant to Section 4.4 of the Fulton County Non-Discrimination in Purchasing and Contracting Ordinance.

SIGNATURE:_____

ADDRESS:_____

_____

TELEPHONE NUMBER:_____

EXHIBIT B – EMPLOYMENT REPORT

The demographic employment make-up for the bidder must be identified and submitted with this bid/proposal. In addition, if subcontractors will be utilized by the bidder/proposer to complete this project, then the demographic employment make-up of the subcontractor(s) must be identified and submitted with this bid.

JOB CATEGORIES	**TOTAL EMPLOYED**		**TOTAL MINORITIES**		WHITE (Not Hispanic Origin)		BLACK or AFRICAN AMERICAN (Not of Hispanic Origin)		HISPANIC or LATINO		AMERICAN INDIAN or ALASKAN NATIVE (AIAN)		ASIAN		NATIVE HAWAIIAN or OTHER PACIFIC ISLANDER (NHOP)		TWO or MORE RACES	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
EXECUTIVE/SENIOR LEVEL OFFICIALS and MANAGERS																		
FIRST/MID LEVEL OFFICIALS and MANAGERS																		
PROFESSIONALS																		
TECHNICIANS																		
SALES WORKERS																		
ADMINISTRATIVE SUPPORT WORKERS																		
CRAFT WORKERS																		
OPERATIVES																		
LABORERS & HELPERS																		
SERVICE WORKERS																		
TOTAL																		

FIRMS'S NAME _____

ADDRESS _____

TELEPHONE _____

This completed form is for (Check only one): _____ Bidder/Proposer _____ Subcontractor

Submitted by: _____ Date Completed: _____

EXHIBIT C - SCHEDULE OF INTENDED SUBCONTRACTOR UTILIZATION

If the bidder/proposer intends to subcontract any portion of this scope of work/service(s), this form **must be** completed and **submitted with the bid/proposal.** All prime bidders/proposers **must** include Letter(s) of Intent (Exhibit D) in the bid document for all subcontractors who will be utilized under the scope of work/services.

Prime Bidder/Proposer:_____

ITB/RFP Number:_____

Project Name or Description of Work/Service(s):_____

_____

_____

1. My firm, as Prime Bidder/Proposer on this scope of work/service(s) is_____is not____a minority or female owned and controlled business enterprise. (Please indicate below the portion of work, including, percentage of bid/proposal amount that your firm will carry out directly):

   _____

   _____

2. If the Prime Bidder/Proposer is a Joint Venture, please complete Exhibit F: Joint Venture Disclosure Affidavit and attach a copy of the executed Joint Venture Agreement.

3. Sub-Contractors (including suppliers) to be utilized in the performance of this scope of work/service(s), if awarded, are:

SUBCONTRACTOR NAME:_____
ADDRESS:_____
_____
PHONE:_____
CONTACT PERSON:_____
ETHNIC GROUP*:_____COUNTY CERTIFIED**_____
WORK TO BE PERFORMED:_____
_____
DOLLAR VALUE OF WORK: $_____ PERCENTAGE VALUE:_____%

***Ethnic Groups: African American (AABE); Asian American (ABE); Hispanic American (HBE); Native American (NABE); White Female American (WFBE); **If yes, please attach copy of recent certification.**

SUBCONTRACTOR NAME:_____
ADDRESS:_____
_____
PHONE:_____
CONTACT PERSON:_____
ETHNIC GROUP*:_____COUNTY CERTIFIED**_____
WORK TO BE PERFORMED:_____
_____
DOLLAR VALUE OF WORK: $_____ PERCENTAGE VALUE:_____%

SUBCONTRACTOR NAME:_____
ADDRESS:_____
_____
PHONE:_____
CONTACT PERSON:_____
ETHNIC GROUP*:_____COUNTY CERTIFIED**_____
WORK TO BE PERFORMED:_____
_____
DOLLAR VALUE OF WORK: $_____ PERCENTAGE VALUE:_____%

SUBCONTRACTOR NAME:_____
ADDRESS:_____
_____
PHONE:_____
CONTACT PERSON:_____
ETHNIC GROUP*:_____COUNTY CERTIFIED**_____
WORK TO BE PERFORMED:_____
_____
DOLLAR VALUE OF WORK: $_____ PERCENTAGE VALUE:_____%

SUBCONTRACTOR NAME:_____
ADDRESS:_____
_____
PHONE:_____
CONTACT PERSON:_____
ETHNIC GROUP*:_____COUNTY CERTIFIED**_____
WORK TO BE PERFORMED:_____
_____
DOLLAR VALUE OF WORK: $_____ PERCENTAGE VALUE:_____%

***Ethnic Groups: African American (AABE); Asian American (ABE); Hispanic American (HBE); Native American (NABE); White Female American (WFBE); **If yes, please attach copy of recent certification.**

Total Dollar Value of Subcontractor Agreements: ($)

Total Percentage Value: (%)

CERTIFICATION: The undersigned certifies that he/she has read, understands and agrees to be bound by the Bid/Proposer provisions, including the accompanying Exhibits and other terms and conditions regarding sub-contractor utilization. The undersigned further certifies that he/she is legally authorized by the Bidder/Proposer to make the statement and representation in this Exhibit and that said statements and representations are true and correct to the best of his/her knowledge and belief. The undersigned understands and agrees that if any of the statements and representations are made by the Bidder/Proposer knowing them to be false, or if there is a failure of the intentions, objectives and commitments set forth herein without prior approval of the County, then in any such event the Contractor's acts or failure to act, as the case may be, shall constitute a material breach of the contract, entitling the County to terminate the Contract for default. The right to so terminate shall be in addition to, and in lieu of, any other rights and remedies the County may have for other defaults under the contract.

Signature:_____**Title**:_____

Firm or Corporate Name:_____

Address:_____

_____

Telephone: ( )_____

Fax Number: ( )_____

Email Address:_____

EXHIBIT D

LETTER OF INTENT TO PERFORM AS A SUBCONTRACTOR
OR
PROVIDE MATERIALS OR SERVICES

This form **must** be completed by **ALL** known subcontractor and submitted with the bid/proposal. The Prime Contractor **must** submit Letters of Intent for **ALL** known subcontractors at time of bid submission.

To:_____
(Name of Prime Contractor Firm)

From:_____
(Name of Subcontractor Firm)

ITB/RFP Number:_____

Project Name:_____

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project (specify in detail particular work items, materials, or services to be performed or provided):

Description of Work	Project Commence Date	Project Completion Date	Estimated Dollar Amount

_____ _____
(Prime Bidder) **(Subcontractor)**

Signature_____ **Signature**_____

Title_____ **Title**_____

Date_____ **Date**_____

EXHIBIT E - DECLARATION REGARDING SUBCONTRACTING PRACTICES

If the bidder/proposer **does not intend to subcontract** any portion of the scope of work services(s), this form **must be** completed and submitted with the bid/proposal.

_____hereby declares that it is my/our intent to
(Bidder)

perform 100% of the work required for_____
(ITB/RFP Number)

_____
(Description of Work)

In making this declaration, the bidder/proposer states the following:

1. That the bidder/proposer does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform **all elements** of the work on this project with his/her own current work forces;

2. If it should become necessary to subcontract some portion of the work at a later date, the bidder/proposer will comply with all requirements of the County's Non-Discrimination Ordinance in providing equal opportunities to all firms to subcontract the work. The determination to subcontract some portion of the work at a later date shall be made in good faith and the County reserves the right to require additional information to substantiate a decision made by the bidder/proposer to subcontract work following the award of the contract. Nothing contained in this provision shall be employed to circumvent the spirit and intent of the County's Non-Discrimination Ordinances;

3. The bidder will provide, upon request, information sufficient for the County to verify Item Number one.

AUTHORIZED COMPANY REPRESENTATIVE

Name:_____ **Title:**_____ **Date:**_____

Signature:_____

Firm:_____

Address:_____

Phone Number:_____

Fax Number:_____

Email Address:_____

EXHIBIT F - JOINT VENTURE DISCLOSURE AFFIDAVIT

ITB/RFP No._____

Project Name_____

This form must be completed and submitted with the bid/proposal if a joint venture approach is to be undertaken.

In order to evaluate the extent of small, minority and female business involvement being proposed by a Bidder/Proposer, certain relevant information must be provided prior to contract award. The information requested below is to clearly identify and explain the extent of small business participation in the proposed joint venture. All items must be properly addressed before the business entity can be evaluated.

1. Firms:

1) **Name of Business:_____**
Street Address:_____
Telephone No.:_____
Nature of Business:_____

2) Name of Business:_____
Street Address:_____
Telephone No.:_____
Nature of Business:_____

3) Name of Business:_____
Street Address:_____
Telephone No.:_____
Nature of Business:_____

NAME OF JOINT VENTURE (If applicable):_____

ADDRESS:_____

_____

PRINCIPAL OFFICE:_____

OFFICE PHONE:_____

Note: Attach additional sheets as required

1. Describe the capital contributions by each joint venturer and accounting thereof.

2. Describe the financial controls of the joint venture, e.g., will a separate cost center be established? Which venturer will be responsible for keeping the books? How will the expense therefore be reimbursed? What is the authority of each joint venture to commit or obligate the order?

3. Describe any ownership, options for ownership, or loans between the joint ventures. Identify terms thereof.

4. Describe the estimated contract cash flow for each joint venturer.

5. To what extent and by whom will the on-site work be supervised?

6. To what extent and by whom will the administrative office be supervised?

7. Which joint venturer will be responsible for material purchases including the estimated cost thereof? How will the purchase be financed?

8. Which joint venturer will provide equipment? What is the estimated cost thereof? How will the equipment be financed?

9. Describe the experience and business qualifications of each joint venturer.

10. Submit a copy of all joint venture agreements and evidence of authority to do business in the State of Georgia as well as locally, to include all necessary business licenses.

11. Percent of Minority/Female Business Enterprises ownership by each joint venture in terms of profit and loss sharing:_____

12. The authority of each joint venturer to commit or obligate the other:_____

13. Number of personnel to be involved in project, their crafts and positions and whether they are employees of the Minority/Female Business Enterprises enterprise, the majority firm or the joint venture: _____

14. Identification of control and participation in venture; list those individuals who are responsible for day-to-day management and policy decision-maker, including, but not limited to, those with prime responsibility for areas designated below; (use additional sheets if necessary)

Name	Race	Sex	Financial Decisions	Supervision Field Operation
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

In connection with any work that these firms, as a joint venture, might be authorized to perform in connection with above captioned contract, we each do hereby authorize representatives of the Fulton County Department of Contract Compliance, Departments of Purchasing and Contract Compliance, and Finance, under the direction of the County Manger's Office, to examine, from time to time, the books, records and files to the extent that such relate to this County project.

WE DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THE FOREGOING DOCUMENT ARE TRUE AND CORRECT, AND THAT WE ARE AUTHORIZED, ON BEHALF OF THE ABOVE FIRMS, TO MAKE THIS AFFIDAVIT AND GRANT THE ABOVE PRIVILEGE.

FOR_____
(Company)

Date:_____ **_____**
(Signature of Affiant)

_____
(Printed Name)

_____
(Company)

Date:_____ **_____**
(Signature of Affiant)

_____
(Printed Name)

State of_____:

County of_____:

On this _____ day of _____, 20___, before me, appeared _____, the undersigned officer, personally appeared _____ known to me to be the person described in the foregoing Affidavit and acknowledges that he (she) executed the same in the capacity therein stated and for the purpose therein contained.

EXHIBIT – G PRIME CONTRACTOR/SUB-CONTRACTOR UTILIZATION REPORT

This report **must** be submitted by the **tenth day** of each month, along with a copy of your monthly invoice (schedule of values/payment application) to Contract Compliance. Failure to comply **shall** result in the County commencing proceedings to impose sanctions to the prime contractor, in addition to pursuing any other available legal remedy. Sanctions may include the suspending of any payment or part thereof, termination or cancellation of the contract, and the denial of participation in any future contracts awarded by Fulton County.

REPORTING PERIOD		**PROJECT NAME:**	
FROM:		**PROJECT NUMBER:**	
TO:		**PROJECT LOCATION:**	

PRIME CONTRACTOR		**Contract Award Date**	**Contract Award Amount**	**Change Order Amount**	**Contract Period**	**% Complete to Date**
Name:						
Address:						
Telephone #:						

AMOUNT OF REQUISITION THIS PERIOD: $_____
TOTAL AMOUNT REQUISITION TO DATE: $_____
TOTAL AMOUNT REQUISITION TO DATE: $_____

SUBCONTRACTOR UTILIZATION (add additional rows as necessary)

Name of Sub-Contractor	**Description of Work**	**Contract Amount**	**Amount Paid To Date**	**Amount Requisition This Period**	**Contract Period Starting Date**	**Ending Date**
TOTALS						

Executed By: _____ _____
(Signature) ***(Printed Name)***
Notary: _____ **Date:** _____ **My Commission Expires:** _____

Should you have questions regarding any of the documents contained in Section 7, please feel free to contact the Office of Contract Compliance at (404) 763-6300, for further assistance.

EXHIBIT H

FULTON COUNTY FIRST SOURCE JOBS PROGRAM

STATEMENT OF POLICY:

It is the policy of Fulton County Government to provide employment opportunities to the citizens of Fulton County. This policy will apply to all contracts procured through the Department of Purchasing & Contract Compliance valued in excess of $200,000. The Prime Contractor is expected to utilize the First Source Jobs Program to fill 50% of the entry level jobs which arise as a result of any project funded in whole or in part with County funds with residents of Fulton County.

PURPOSE:

The purpose of this policy is to create a pool of employable persons who are residents of Fulton County to be called upon as a source to fill jobs created as a result of any eligible project funded in whole or in part with County funds in order to provide stable economic opportunities for families throughout the County. The First Source Jobs Program will be implemented by the Department of Purchasing & Contract Compliance and the Office of Workforce Development.

MONITORING POLICY:

Upon execution of a contract with Fulton County Government, the First Source Jobs Agreement (FSJ Form 2) will become a part of the contract between the bidder/proposer and Fulton County Government. The First Source Jobs Program will be monitored during routine site visits by the Office of Contract Compliance along with the Office of Workforce Development.

FORM 1

FULTON COUNTY

First Source Jobs Program Information

Company Name: _____

Project Number: _____

Project Name: _____

The following entry-level positions will become available as a result of the above referenced contract with Fulton County.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Include a job description and all required qualifications for each position listed above.

Identify a company representative and contact phone number who will be responsible for coordinating with the First Source Jobs Program:

Company Representative: _____

Phone Number: _____

Email Address: _____

FORM 2

FULTON COUNTY
First Source Jobs Program Agreement

Awarded Contractor's Name: _____

Formal Contract Name: _____

RFP/ITB Number: _____

Contact Person: _____

Contact Phone: _____

The contractor listed above agrees to the following:

1. The contractor shall make a good faith effort to fill 50% of the entry level position(s) created by this project using the Fulton County First Source Jobs Program.

2. The contractor shall provide the applicable details of every entry level job in writing within the required form.

3. The contractor shall be expected to present documentation that confirms employment terms to both the employee and Fulton County.

The Office of Contract Compliance will assist with monitoring the participation of First Source Jobs Program employees during routine site visits and report findings to the Office of Workforce Development for confirmation and follow-up. The Office of Workforce Development shall notify the Director of Human Services and the Purchasing Agent of any determination of non-compliance with the requirements of this policy and recommend a resolution or action to be taken.

Upon a determination by the Purchasing Agent and the Director of Human Services that a contractor has failed to comply with any portion of this policy, the County may impose the following:

1. Ten percent (10%) of all future payments under the involved eligible project shall be entitled to be withheld from a contractor that has violated this policy until the contractor complies with the provisions of this policy.

The undersigned agrees to the terms and conditions set forth in this agreement.

Contractor's Official Title: _____ Date: _____

Contractor's Name: _____

Contractor's Signature: _____

FORM 3

SECTION 8
GENERAL CONDITIONS

00700-1 FAMILIARITY WITH SITE

Execution of this agreement by the Contractor is a representation that the Contractor has visited the site, has become familiar with the local conditions under which the work is to be performed, and has correlated personal observations with the requirements of this agreement.

00700-2 CONTRACT DOCUMENTS

This agreement consists of Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, the contract, general conditions, special conditions, specifications, plans, drawings, exhibits, addenda, and written change orders.

A. Notice of Award of Contract:

B. Execution of Contract Documents

Upon notification of Award of Contract, the Owner shall furnish the Contractor the conformed copies of Contract Documents for execution by the Contractor and the Contractor's surety.

Within ten (10) days after receipt the Contractor shall return all the documents properly executed by the Contractor and the Contractor's surety. Attached to each document shall be an original power-of-attorney for the person executing the bonds for the surety and certificates of insurance for the required insurance coverage.

After receipt of the documents executed by the Contractor and his surety with the power-of-attorney and certificates of insurance, the Owner shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.

Should the Contractor and/or Surety fail to execute the documents within the time specified; the Owner shall have the right to proceed on the Bid Bond accompanying the bid.

If the Owner fails to execute the documents within the time limit specified, the Contractor shall have the right to withdraw the Contractor's bid without penalty.

Drawings and Specifications:

The Drawings, Specifications, Contract Documents, and all supplemental documents, are considered essential parts of the Contract, and requirements occurring in one are as binding as though occurring in all. They are intended to define, describe and provide for all Work necessary to complete the Project in an acceptable manner, ready for use, occupancy, or operation by the Owner.

In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

In cases where products or quantities are omitted from the Specifications, the description and quantities shown on the Drawings shall govern.

Any ambiguities or need for clarification of the Drawings or Specifications shall be immediately reported to the Construction Manager in writing. Any such ambiguity or need for clarification shall be handled by the Construction Manager in writing. No clarification of the Drawings and Specifications hereunder by the Construction Manager shall entitle the Contractor to any additional monies unless a Change Order has been processed as provided by "Changes in the Contract" hereof.

Any work done by the Contractor following a discovery of such differing site condition or ambiguity or need for clarification in the Contract Drawings and Specifications prior to a written report to the Construction Manager shall not entitle the Contractor to additional monies and shall be done at the Contractor's risk.

The Construction Manager will furnish the Contractor five (5) copies of the Contract Drawings and the Specifications, one copy of which the Contractor shall have available at all times on the Project site.

00700-3 DEFINITIONS

The following terms as used in this agreement are defined as follows to the extent the definitions herein differ or conflict with those in the Instructions for Bidders, Section 1, the definitions herein shall control.

Alternate Bids – the amount stated in the bid or proposal to be added to or deducted from the amount of the base bid or base proposal if the corresponding change in project scope or alternate materials or methods of construction is accepted.

Base Bid – the amount of money stated in the bid or proposal as the sum for which the bidder or proposer offers to perform the work.

Change Order - an alteration, addition, or deduction from the original scope of work as defined by the contract documents to address changes or unforeseen conditions necessary for project completion. A written order to the Contractor issued by the County pursuant to Fulton County Policy and Procedures 800-6 for changes in the work within the general scope of the contract documents, adjustment of the contract price, extension of the contract time, or reservation of determination of a time extension.

Construction Manager shall mean the individual designated in writing, by the Director of the Facilities and Transportation Services Department as the Construction Manager.
Contractor shall mean the party of the second part to the Contract Agreement or the authorized and legal representative of such party.

Contract Documents include the Contract Agreement, Contractor's Bid (including all documentation accompanying the Bid and any post-Bid documentation required by the County prior to the Notice of Award), Bonds, all Special Conditions, General Conditions, Supplementary Conditions, Specifications, Drawings and addenda, together with written amendments, change orders, field orders and the Construction Manager's written interpretations and clarifications

issued in accordance with the General Conditions on or after the date of the Contract Agreement.

Shop drawing submittals reviewed in accordance with the General Conditions, geotechnical investigations and soils report and drawings of physical conditions in or relating to existing surface structures at or contiguous to the site are not Contract Documents.

Contract Price - The sum specified in the Agreement to be paid to the Contractor in consideration of the Work.

Contract Time shall mean the number of consecutive calendar days as provided in the Contract Agreement for the Substantial Completion of the Work or Final completion of the Work, or the achievement of a specific interim milestone, as the context may require. The Contract Time shall be computed from the date of Notice to Proceed.

Owner or County shall mean Fulton County Government, party of the first part to the Contract Agreement, or its authorized and legal representatives.

Day - A calendar day of twenty-four hours lasting from midnight of one day to midnight the next day.

Director - Director of the Department of Public Works of Fulton County, Georgia or the designee thereof.

Engineer of Record – Shaw Environmental & Infrastructure, Inc. (A CB&I Company), developed the specifications and drawings referred to herein.

Final Completion shall mean the completion of all work as required in accordance with the terms and conditions of the contract documents.

Liquidated Damages shall mean the amount, stated in the Contract Agreement, which the Contractor agrees to pay to the Owner for each consecutive calendar day beyond the Contract time required to complete the Project or for failing to comply with associated milestones. Liquidated Damages will end upon written notification from the Owner of Final Acceptance of the Project or upon written notification of from the Owner of completion of the milestone.

Notice to Proceed - A written communication issued by the County to the Contractor authorizing it to proceed with the work, establishing the date of commencement and completion of the work, and providing other direction to the Contractor.

Products shall mean materials or equipment permanently incorporated into the work.

Program Manager - Not used in this contract. Delete all references.

Project Manual - The Contract Documents.

Provide shall mean to furnish and install.

Substantial Completion - The date certified by the Construction Manager when all or a part of the work, as established pursuant to General Condition 0700-81, is sufficiently completed in

accordance with the requirements of the contract documents so that the identified portion of the work can be utilized for the purposes for which it is intended.

Work or Project - All of the services specified, indicated, shown or contemplated by the contract documents, and furnishing by the Contractor of all materials, equipment, labor, methods, processes, construction and manufacturing materials and equipment, tools, plans, supplies, power, water, transportation and other things necessary to complete such services in accordance with the contract documents to insure a functional and complete facility.

00700-4 CODES

All codes, specifications, and standards referenced in the contract documents shall be the latest editions, amendments and revisions of such referenced standards in effect as of the date of the request for proposals for this contract.

00700-5 REVIEW OF CONTRACT DOCUMENTS

Before making its proposal to the County, and continuously after the execution of the agreement, the Contractor shall carefully study and compare the contract documents and shall at once report to the Construction Manager any error, ambiguity, inconsistency or omission that may be discovered, including any requirement which may be contrary to any law, ordinance, rule, or regulation of any public authority bearing on the performance of the work. By submitting its proposal, the Contractor agrees that the contract documents, along with any supplementary written instructions issued by or through the Construction Manager that have become a part of the contract documents, appear accurate, consistent and complete insofar as can be reasonably determined. If the Contractor has timely reported in writing any error, inconsistency, or omission to the Construction Manager, has properly stopped the affected work until instructed to proceed, and has otherwise followed the instructions of the Construction Manager, the Contractor shall not be liable to the County for any damage resulting from any such error, inconsistency, or omission in the contract documents. The Contractor shall not perform any portion of the work without the contract documents, approved plans, specifications, products and data, or samples for such portion of the work. For purposes of this section “timely” is defined as the time period in which the contractor discovers, or should have discovered, the error, inconsistency, or omission, with the exercise of reasonable diligence.

00700-6 STRICT COMPLIANCE

No observation, inspection, test or approval of the County or Construction Manager shall relieve the Contractor from its obligation to perform the work in strict conformity with the contract documents except as provided in General Condition 00700-48.

00700-7 APPLICABLE LAW

All applicable State laws, County ordinances, codes, and rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to this agreement. The Contractor shall comply with the requirements of any Fulton County program concerning non-discrimination in contracting. All work performed within the right of way of the Georgia Department of Transportation and any railroad crossing shall be in accordance with Georgia Department of Transportation regulations, policies and procedures and, where applicable, those of any affected railroad. The Contractor shall comply with all laws, ordinances, codes, rules and

regulations bearing on the conduct of the work as specified and the Contractor agrees to indemnify and hold harmless the County, its officers, agents and employees, as well as the Construction Manager and the Program Manager against any claim or liability arising from or based on the violation of any law, ordinance, regulation, order or decree affecting the conduct of the work, whether occasioned by the Contractor, his agents or employees.

00700-8 PERMITS, LICENSES AND BONDS

All permits and licenses necessary for the work shall be secured and paid for by the Contractor. If any permit, license or certificate expires or is revoked, terminated, or suspended as a result of any action on the part of the Contractor, the Contractor shall not be entitled to additional compensation or time. The Contractor shall obtain and keep in force at all times performance and payment bonds payable to Fulton County in penal amounts equal to 100% of the Contract price.

00700-9 TAXES

A. The Contractor shall pay all sales, retail, occupational, service, excise, old age benefit and unemployment compensation taxes, consumer, use and other similar taxes, as well as any other taxes or duties on the materials, equipment, and labor for the work provided by the Contractor which are legally enacted by any municipal, county, state or federal authority, department or agency at the time bids are received, whether or not yet effective. The Contractor shall maintain records pertaining to such taxes and levies as well as payment thereof and shall make the same available to the County at all reasonable times for inspection and copying. The Contractor shall apply for any and all tax exemptions which may be applicable and shall timely request from the County such documents and information as may be necessary to obtain such tax exemptions. The County shall have no liability to the Contractor for payment of any tax from which it is exempt.

B. The Contractor is obligated to comply with all local and State Sales and Use Tax laws. The Contractor shall provide the Owner with documentation to assist the Owner in obtaining sales and/or use tax refunds for eligible machinery and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia. All taxes shall be paid by the Contractor. All refunds will accrue to the Owner.

Acceptance of the project as complete and final payment will not be made by the Owner until the Contractor has fully complied with this requirement.

00700-10 DELINQUENT CONTRACTORS

The County shall not pay any claim, debt, demand or account whatsoever to any person firm or corporation who is in arrears to the County for taxes. The County shall be entitled to a counterclaim, backcharge, and offset for any such debt in the amount of taxes in arrears, and no assignment or transfer of such debt after the taxes become due shall affect the right of the County to offset any taxes owed against said debt.

00700-11 LIEN WAIVERS

The Contractor shall furnish the County with evidence that all persons who have performed work or furnished materials pursuant to this agreement have been paid in full prior to submitting

its demand for final payment pursuant to this agreement. A final affidavit, Exhibit A, must be completed, and submitted to comply with requirements of 00700-11. In the event that such evidence is not furnished, the County may retain sufficient sums necessary to meet all lawful claims of such laborers and materialmen. The County assumes no obligation nor in any way undertakes to pay such lawful claims from any funds due or that may become due to the Contractor.

00700-12 MEASUREMENT

All items of work to be paid for per unit of measurement shall be subject to inspection, measurement, and confirmation by the Construction Manager.

00700-13 ASSIGNMENT

The Contractor shall not assign any portion of this agreement or moneys due there from (include factoring of receivables) without the prior written consent of the County. The Contractor shall retain personal control and shall provide personal attention to the fulfillment of its obligations pursuant to this agreement. Any assignment without the express written consent of the County shall render this contract voidable at the sole option of the County.

00700-14 FOREIGN CONTRACTORS

In the event that the Contractor is a foreign corporation, partnership, or sole proprietorship, the Contractor hereby irrevocably appoints the Secretary of State of Georgia as its agent for service of all legal process for the purpose of this contract only.

00700-15 INDEMNIFICATION

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or Construction Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the Construction Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the Construction Manager, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County,

in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor.

00700-16 SUPERVISION OF WORK AND COORDINATION WITH OTHERS

The Contractor shall supervise and direct the work using the Contractor's best skill and attention. The Contractor shall be solely responsible for all construction methods and procedures and shall coordinate all portions of the work pursuant to the contract subject to the overall coordination of the Construction Manager. All work pursuant to this agreement shall be performed in a skillful and workmanlike manner.

The County reserves the right to perform work related to the Project with the County's own forces and to award separate contracts in connection with other portions of the project, other work on the site under these or similar conditions of the contract, or work which has been extracted from the Contractor's work by the County.

When separate contracts are awarded for different portions of the project or other work on the site, the term "separate contractor" in the Contract Documents in each case shall mean the contractor who executes each separate County Agreement.

The Contractor shall cooperate with the County and separate contractors in arranging the introduction and storage of materials and equipment and execution of their work, and shall cooperate in coordinating connection of its work with theirs as required by the Contract Documents.

If any part of the Contractor's Work depends for proper execution or results upon the work of the County or any separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results **within fourteen (14) days** of discovery of such discrepancy or defect. Failure of the Contractor to so report in writing shall constitute an acceptance of the County's or separate contractor's work as fit and proper to receive the Work, except as to any defects which may subsequently become apparent in such work by others.

Any costs caused by defective or untimely work shall be borne by the party responsible therefore.

Should the Contractor wrongfully cause damage to the work or property of the County or to other work or property on the site, including the work of separate contractors, the Contractor shall promptly remedy such damage at the Contractor's expense.

Should the Contractor be caused damage by any other contractor on the Project, by reason of such other contractor's failure to perform properly his contract with the County, no action shall lie against the County or the Construction Manager inasmuch as the parties to this agreement are the only beneficiaries hereof and there are no third party beneficiaries and neither the County nor the Construction Manager shall have liabilities therefore, but the Contractor may assert his claim for damages solely against such other contractor. The Contractor shall not be excused from performance of the contract by reason of any dispute as to damages with any other contractor or third party.

Where the Work of this Contract shall be performed concurrently in the same areas as other construction work, the Contractor shall coordinate with the Construction Manager and the separate contractors in establishing mutually acceptable schedules and procedures that shall permit all jobs to proceed with minimum interference.

If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up, the County may clean up and charge the cost thereof to the Contractor or contractors responsible therefore as the County shall determine to be just.

00700-17 ADMINISTRATION OF CONTRACT

The Program Manager and the Construction Manager shall provide administration services as hereinafter described.

For the administration of this Contract, the Construction Manager shall serve as the County's primary representative during design and construction and until final payment to the Contractor is due. The Construction Manager shall advise and consult with the County and the Program Manager. The primary point of contact for the Contractor shall be the Construction Manager. All correspondence from the Contractor to the County shall be forwarded through the Construction Manager. Likewise, all correspondence and instructions to the Contractor shall be forwarded through the Construction Manager.

The Construction Manager will determine in general that the construction is being performed in accordance with design and engineering requirements, and will endeavor to guard the County against defects and deficiencies in the Work.

The Construction Manager will not be responsible for or have control or charge of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, nor will it be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Construction Manager will not be responsible for or have control or charge over the acts or omissions of the Contractor, its engineers, consultants, subcontractors, or any of their agents or employees, or any other persons performing the Work.

Based on the Construction Manager's observations regarding the Contractor's Applications for Payment, the Construction Manager shall determine the amounts owing to the Contractor, in accordance with the payment terms of the Contract, and shall issue Certificates for Payment in such amount to the County.

The Construction Manager shall render interpretations necessary for the proper execution or progress of the Work. Either party to the Contract may make written requests to the Construction Manager for such interpretations.

Claims, disputes and other matters in question between the Contractor and the County relating to the progress of the Work or the interpretation of the Contract Documents shall be referred to the Construction Manager for interpretation.

All interpretations of the Construction Manager shall be consistent with the intent of and reasonably inferable from the Contract Documents and shall be in writing or in graphic form.

Except as otherwise provided in this Contract, the Construction Manager shall issue a decision on any disagreement concerning a question of fact arising under this Contract. The Construction Manager shall reduce the decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Construction Manager shall be final and conclusive unless, within thirty (30) days from the date of receipt of such copy, the Contractor files a written appeal with the Director of Public Works and mails or otherwise furnishes the Construction Manager a copy of such appeal. The decision of the Director of Public Works or the Director's duly authorized representative for the determination of such appeals shall be final and conclusive. Such final decision shall not be pleaded in any suit involving a question of fact arising under this Contract, provided such is not fraudulent, capricious, arbitrary, so grossly erroneous as necessarily implying bad faith, or is not supported by substantial evidence. In connection with any appeal proceeding under this Article, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of Contractor's appeal. Pending any final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract as directed by the Construction Manager.

The Construction Manager shall have authority to reject Work which does not conform to the Contract Documents. Whenever, in the Construction Manager's opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the County shall have authority to require special inspection or testing of the Work whether or not such Work be then fabricated, installed or completed. The Contractor shall pay for such special inspection or testing if the Work so inspected or tested is found not to comply with the requirements of the contract; the County shall pay for special inspection and testing if the Work is found to comply with the contract. Neither the Construction Manager's authority to act under this Subparagraph, nor any decision made by the Construction Manager in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Construction Manager to the Contractor, any subcontractor, any of their agents or employees, or any other person performing any of the Work.

The Contractor shall provide such shop drawings, product data, and samples as may be required by the Construction Manager and/or as required by these Contract Documents.

The Construction Manager shall conduct inspections to determine Substantial Completion and Final Completion, and shall receive and forward to the County for review written warranties and related documents required by the Contract Documents and assembled by the Contractor. The Construction Manager shall approve and issue Certificates for Payment upon compliance with Substantial and Final Completion requirements indicated in General Conditions 00700-81, 00700-82, 00700-84 and 00700-85 of this Agreement.

Except as provided in General Condition 00700-48, the Contractor shall not be relieved from the Contractor's obligations to perform the work in accordance with the contract documents by the activities or duties of the County or any of its officers, employees, or agents, including inspections, tests or approvals, required or performed pursuant to this agreement.

00700-18 RESPONSIBILITY FOR ACTS OF EMPLOYEES

The Contractor shall employ only competent and skilled personnel. The Contractor shall, upon demand from the Construction Manager, immediately remove any superintendent, foreman or workman whom the Construction Manager may consider incompetent or undesirable.

The Contractor shall be responsible to the County for the acts and omissions of the Contractor's employees, subcontractors, and agents as well as any other persons performing work pursuant to this agreement for the Contractor.

00700-19 LABOR, MATERIALS, SUPPLIES, AND EQUIPMENT

Unless otherwise provided in this agreement, the Contractor shall make all arrangements with necessary support agencies and utility companies provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the execution and completion of the work.

00700-20 DISCIPLINE ON WORK SITE

The Contractor shall enforce strict discipline and good order among its employees and subcontractors at all times during the performance of the work, to include compliance with the Fulton County Drug Free Work Place Policy. The Contractor shall not employ any subcontractor who is not skilled in the task assigned to it. The Construction Manager may, by written notice, require the Contractor to remove from the work any subcontractor or employee deemed by the Construction Manager to be incompetent.

00700-21 HOURS OF OPERATION

All work at the construction site shall be performed during regular business hours of the Fulton County government, except upon the Construction Manager's prior written consent to other work hours. It is further understood that the Contractor's construction schedule is based on a normal 40 hours, five day work week, less Fulton County-recognized holidays. Contractors work schedule shall not violate Fulton County Noise Ordinance by working hours inconsistent with the Fulton County Noise Ordinance. The County's current noise ordinance or other applicable ordinance shall govern. If the Contractor desires to work in excess of this limit, the Contractor shall submit a written request to the Construction Manager, a minimum of five days prior to the desired work date. The Contractor shall be responsible for any additional expenses incurred by the Owner as a result of the extended work hours, including resident inspection overtime. The cost associated with resident inspector overtime shall be deducted form the Contractor monthly payment request.

00700-22 FAMILIARITY WITH WORK CONDITIONS

The Contractor shall take all steps necessary to ascertain the nature and location of the work and the general and local conditions which may affect the work or the cost thereof. The Contractor's failure to fully acquaint itself with the conditions which may affect the work, including, but not limited to conditions relating to transportation, handling, storage of materials, availability of utilities, labor, water, roads, weather, topographic and subsurface conditions, other separate contracts to be entered into by the County relating to the project which may affect the work of the Contractor, applicable provisions of law, and the character and availability of equipment and facilities necessary prior to and during the performance of the work shall not relieve the Contractor of its responsibilities pursuant to this agreement and shall not constitute a basis for an equitable adjustment of the contract terms. The County reserves the right to perform with its own forces or to contract with other entities for other portions of the project work, in which case the Contractor's responsibility to assure its familiarity with work conditions hereunder shall include all coordination with such other contractors and the County necessary to insure that there is no interference between contractors as will delay or hinder any contractor

in its prosecution of work on the project. The County assumes no responsibility for any understandings or representations concerning conditions of the work made by any of its officers, agents, or employees prior to the execution of this agreement.

00700-23 RIGHT OF ENTRY

The County reserves the right to enter the site of the work by such agent, including the Construction Manager, as it may elect for the purpose of inspecting the work or installing such collateral work as the County may desire. The Contractor shall provide safe facilities for such access so that the County and its agents may perform their functions.

00700-24 NOTICES

Any notice, order, instruction, claim or other written communication required pursuant to this agreement shall be deemed to have been delivered or received as follows:

Upon personal delivery to the Contractor, its authorized representative, or the Construction Manager on behalf of the County. Personal delivery may be accomplished by in-person hand delivery or bona fide overnight express service.

Three days after depositing in the United States mail a certified letter addressed to the Contractor or the Construction Manager for the County. For purposes of mailed notices, the County's mailing address shall be 141 Pryor Street, 6th Floor, Atlanta, Georgia 30303, or as the County shall have otherwise notified the Contractor. The Contractor's mailing address shall be the address stated in its proposal or as it shall have most recently notified the Construction Manager in writing.

00700-25 SAFETY

A. SAFETY, HEALTH AND LOSS PREVENTION

The Contractor shall be responsible for implementing a comprehensive project-specific safety, health and loss prevention program and employee substance abuse program for this project. All Sub-Contractors must either implement their own program or follow the Contractor’s safety, health and loss prevention program and employee substance abuse program.
The Contractor’s safety, health and loss prevention program and employee substance abuse program must meet or exceed all governmental regulations (OSHA, EPA, DOT, State, local), and any other specific Fulton County requirements.

B. COUNTY’S SAFETY, HEALTH, AND LOSS PREVENTION PROCESS GUIDELINES AND REQUIREMENTS

The County and its agents reserve the right, but assume no duty, to establish and enforce safety, health, and loss prevention guidelines and to make the appropriate changes in the guidelines, for the protection of persons and property and to review the efficiency of all protective measures taken by the Contractor. The Contractor shall comply with all safety, health, and loss prevention process guidelines and requirements and changes made by the County or its agent(s). The issuance of any such guidelines or changes by the County or its agent(s) shall not relieve the Contractor of its duties and responsibilities under this Agreement, and the County or its agent(s) shall not thereby assume, nor be deemed to have assumed, any such duties or responsibilities of the Contractor.

C. COMPLIANCE OF WORK, EQUIPMENT, AND PROCEDURES WITH ALL APPLICABLE LAWS and REGULATIONS

All Work, whether performed by the Contractor or its Sub-Contractors of any tier, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with and conform to:

1. All applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental authority relating to the safety of persons and their protection against injury, specifically including, but in no event limited to, the Federal Occupational Safety and Health Act of 1970, as amended, and all rules and regulations now or hereafter in effect pursuant to said Act.

2. All rules, regulations, and requirements of the County or its agent(s) and its insurance carriers relating there to. In the event of a conflict or differing requirements the more stringent shall govern.

D. PROTECTION OF THE WORK

1. The Contractor shall, throughout the performance of the Work, maintain adequate and continuous protection of all Work and temporary facilities against loss or damage from whatever cause, shall protect the property of the County and third parties from loss or damage from whatever cause arising out of the performance of the Work, and shall comply with the requirements of the County or its agent(s) and its insurance carriers, and with all applicable laws, codes, rules and regulations, (as same may be amended) with respect to the prevention of loss or damage to property as a result of fire or other hazards.

2. The County or its agent(s) may, but shall not be required to, make periodic inspections of the Project work area. In such event, however, the Contractor shall not be relieved of its aforesaid responsibilities and the County or its agent(s) shall not assume, nor shall it be deemed to have assumed, any responsibility otherwise imposed upon the assurance of Contractor by this Agreement.

E. SAFETY EQUIPMENT

1. The Contractor shall provide to each worker on the Project work area the proper safety equipment for the duties being performed by that worker and will not permit any worker on the Project work area who fails or refuses to use the same. The County or its agent shall have the right, but not the obligation, to order the removal of a worker from the Project work site for his/her failure to comply with safe practices or substance abuse policies.

F. EMERGENCIES

1. In any emergency affecting the safety of persons or property, or in the event of a claimed violation of any federal or state safety or health law or regulation, arising out of or in any way connected with the Work or its performance, the Contractor shall act immediately to prevent threatened damage, injury or loss and to remedy said violation. Failing such action the County or its agent(s) may immediately take whatever steps it deems necessary including, but not limited to, suspending the Work as provided in this Agreement.

2. The County or its agent(s) may offset any and all costs or expenses of whatever nature, including attorneys' fees, paid or incurred by the County or its agent(s) (whether such fees are for in-house counsel or counsel retained by the County or

its agent), in taking the steps authorized by Section 00700-25(G) (1) above against any sums then or thereafter due to the Contractor. The Contractor shall defend, indemnify and hold the County, its officers, agents, and employees harmless against any and all costs or expenses caused by or arising from the exercise by the County of its authority to act in an emergency as set out herein. If the Contractor shall be entitled to any additional compensation or extension of time change order on account of emergency work not due to the fault or neglect of the Contractor or its Sub-Contractors, such additional compensation or extension of time shall be determined in accordance with General Condition 00700-52 and General Condition 00700-87 of this Agreement.

G. SUSPENSION OF THE WORK

1. Should, in the judgment of the County or its agent(s), the Contractor or any Sub-Contractor fail to provide a safe and healthy work place, the County or its agent shall have the right, but not the obligation, to suspend work in the unsafe areas until deficiencies are corrected. All costs of any nature (including, without limitation, overtime pay, liquidated damages or other costs arising out of delays) resulting from the suspension, by whomsoever incurred, shall be borne by the Contractor.

2. Should the Contractor or any Sub-Contractor fail to provide a safe and healthy work place after being formally notified in writing by the County or its agents of such non-compliance, the contract may be terminated following the termination provision of the contract.

H. CONTRACTOR'S INDEMNITY OF THE COUNTY FOR CONTRACTOR'S NON-COMPLIANCE WITH SAFETY PROGRAM

1. The Contractor recognizes that it has sole responsibility to assure its Safety Program is implemented and to assure its construction services are safely provided. The Contractor shall indemnify, defend and hold the County and its agents harmless, from and against any and all liability (whether public or private), penalties (contractual or otherwise), losses, damages, costs, attorneys' fees, expenses, causes of action, claims or judgments resulting, either in whole or in part, from any failure of the Contractor, its Sub-Contractors of any tier or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, to comply with the safety requirements of the contract. The Contractor shall not be relieved of its responsibilities under the safety requirements of the Contract should the County or its agent(s) act or fail to act pursuant to its rights hereunder.

2. The Contractor shall not raise as a defense to its obligation to indemnify under this Subparagraph I any failure of those indemnified hereunder to assure Contractor operates safely, it being understood and agreed that no such failure shall relieve the Contractor from its obligation to assure safe operations or from its obligation to so indemnify. The Contractor also hereby waives any rights it may have to seek contribution, either directly or indirectly, from those indemnified hereunder.

3. In any and all claims against those indemnified hereunder by any employee of the Contractor, any Sub-Contractor of any tier or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Subparagraph I shall not be limited in

any way as to the amount or type of damages, compensation or benefits payable by or for the Contractor or any Sub-Contractor of any tier under any workers' compensation act, disability benefit or other employee benefit acts.

00700-26 BLASTING AND EXCAVATION

The Contractor acknowledges that it is fully aware of the contents and requirements of O.C.G.A. § 25-9-1 through 25-9-12 concerning blasting and excavation near underground gas pipes and facilities and shall fully comply therewith.

00700-27 HIGH VOLTAGE LINES

The Contractor acknowledges that it is fully aware of the contents and requirements O.C.G.A. § 46-3-30 through 46-3-39 concerning safeguards against contact with high voltage lines, and the Contractor shall fully comply with said provisions.

00700-28 SCAFFOLDING AND STAGING

The Contractor acknowledges that it is the person responsible for employing and directing others to perform labor within the meaning of O.C.G.A. § 34-1-1 and agrees to comply with said provisions.

00700-29 CLEAN-UP

The Contractor shall clean up all refuse, rubbish, scrap materials, and debris caused by its operations to the end that the site of the work shall present a neat, orderly and workmanlike appearance at all times.

00700-30 PROTECTION OF WORK

The Contractor shall be responsible for maintenance and protection of the work, which shall include any County-furnished supplies, material, equipment, until final completion of this agreement and acceptance of the work as defined herein. Any portion of the work suffering injury, damage or loss shall be considered defective and shall be corrected or replaced by the Contractor without additional cost to the County.

00700-31 REJECTED WORK

The Contractor shall promptly remove from the project all work rejected by the Construction Manager for failure to comply with the contract documents and the Contractor shall promptly replace and re-execute the work in accordance with the contract documents and without expense to the County. The Contractor shall also bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

00700-32 DEFECTIVE WORK

If the Contractor defaults or neglects to carry out any portion of the work in accordance with the contract documents, and fails within three days after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the County may, after three days following receipt by the Contractor

of an additional written notice and without prejudice to any other remedy the County may have, make good such deficiencies and complete all or any portion of any work through such means as the County may select, including the use of a separate Contractor. In such case, an appropriate change order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies. In the event the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the County on demand.

The County may, at its option, accept defective or nonconforming work instead of requiring its removal or correction. In such case, a change order shall be issued reducing the price due the contractor to the extent appropriate and equitable. Such contract price adjustment shall be effected whether or not final payment has been made.

00700-33 WARRANTY OF NEW MATERIALS

The Contractor warrants to the County that all materials and equipment furnished under this contract will be new unless otherwise specified, and the Contractor further warrants that all work will be of good quality, free from faults and defects, and in conformance with the contract documents. The warranty set forth in this paragraph shall survive final acceptance of the work.

00700-34 CONTRACTOR'S WARRANTY OF THE WORK

If within one year after the date of issuance of the certificate of final payment pursuant to General Condition 84, or within such longer period of time as may be prescribed by law or by the term of any applicable special warranty required by the contract documents, any of the work is found to be defective or not in accordance with the contract documents, the Contractor shall correct such work promptly after receipt of written notice from the Construction Manager to do so. This obligation shall survive both final payment for the work and termination of the contract.

00700-35 ASSIGNMENT OF MANUFACTURERS' WARRANTIES

Without limiting the responsibility or liability of the Contractor pursuant to this agreement, all warranties given by manufacturers on materials or equipment incorporated in the work are hereby assigned by the Contractor to the County. If requested, the Contractor shall execute formal assignments of said manufacturer's warranties to the County. All such warranties shall be directly enforceable by the County.

00700-36 WARRANTIES IMPLIED BY LAW

The warranties contained in this agreement, as well as those warranties implied by law, shall be deemed cumulative and shall not be deemed alternative or exclusive. No one or more of the warranties contained herein shall be deemed to alter or limit any other.

00700-37 STOP WORK ORDERS

In the event that the Contractor fails to correct defective work as required by the contract documents or fails to carry out the work in accordance with contract documents, the Construction Manager, in writing, may order the Contractor to stop work until the cause for such order has been eliminated. This right of the County to stop work shall not give rise to any duty

on the part of the County or the Construction Manager to execute this right for the benefit of the Contractor or for any other person or entity.

00700-38 TERMINATION FOR CAUSE

If the Contractor is adjudged bankrupt, makes a general assignment for the benefit of creditors, suffers the appointment of a receiver on account of its insolvency, fails to supply sufficient properly skilled workers or materials, fails to make prompt payment to subcontractors or materialmen, disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, fails to diligently prosecute the work, or is otherwise guilty of a material violation of this agreement and fails within seven days after receipt of written notice to commence and continue correction of such default, neglect, or violation with diligence and promptness, the County may, after seven days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the County may have, terminate the employment of the Contractor and take possession of the site as well as all materials, equipment, tools, construction equipment and machinery thereon. The County may finish the work by whatever methods the County deems expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is completed. If the unpaid balance of the contract price exceeds the cost of completing the work, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the County on demand. This obligation for payment shall survive the termination of the contract. Termination of this agreement pursuant to this paragraph may result in disqualification of the Contractor from bidding on future County contracts.

00700-39 TERMINATION FOR CONVENIENCE

The County may, at any time upon written notice to the Contractor, terminate the whole or any portion of the work for the convenience of the County. The effective data of the terminations shall be provided in the written notice. Said termination shall be without prejudice to any right or remedy of the County provided herein. In addition, in the event this agreement has been terminated due to the default of the Contractor, and if it is later determined that the Contractor was not in default pursuant to the provisions of this agreement at the time of termination, then such termination shall be considered a termination for convenience pursuant to this paragraph.

00700-40 TERMINATION FOR CONVENIENCE - PAYMENT

If the Contract is terminated for convenience by the Owner as provided in this article, Contractor will be paid compensation for those services actually performed as approved by the Owner or his representative. Partially completed tasks will be compensated for based on a signed statement of completion prepared by the Project Manager and submitted to the Contractor which shall itemize each task element and briefly state what work has been completed and what work remains to be done. Contractor shall also be paid for reasonable costs for the orderly filing and closing of the project.

00700-41 TERMINATION FOR CONVENIENCE - PAYMENT LIMITATIONS

Except for normal spoilage, and except to the extent that the County shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor the fair value, as determined by the Construction Manager, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the County or to another buyer.

00700-42 COST TO CURE

If the County terminates for cause the whole or any part of the work pursuant to this agreement, then the County may procure upon such terms and in such manner as the Construction Manager may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the County for any excess costs for such similar supplies or services. The Contractor shall continue the performance of this agreement to the extent not terminated hereunder.

00700-43 ATTORNEY'S FEES

Should the Contractor default pursuant to any of the provisions of this agreement, the Contractor and its surety shall pay to the County such reasonable attorney's fees as the County may expend as a result thereof and all costs, expenses, and filing fees incidental thereto.

00700-44 CONTRACTOR'S RESPONSIBILITIES UPON TERMINATION

After receipt of a notice of termination from the County, and except as otherwise directed by the Construction Manager, the Contractor shall:

1. Stop work under the contract on the date and to the extent specified in the notice of termination;
2. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the agreement as is not terminated;
3. Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;
4. Assign to the County in the manner, at the times, and to the extent directed by the Construction Manager, all of the rights, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the County shall have the right, at its discretion, to settle or pay any and all claims arising out of the termination of such orders or subcontracts;
5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts with the approval or ratification of the Construction Manager, to the extent the Construction Manager may require, which approval or ratification shall be final for all purposes;
6. Transfer title and deliver to the entity or entities designated by the Construction Manager, in the manner, at the times, and to the extent, if any, directed by the Construction Manager, and to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the work as has been terminated:

    a. The fabricated or un-fabricated parts, work, and progress, partially completed supplies, and equipment, materials, parts, tools, dyes, jigs, and other fixtures, completed work, supplies, and other material produced as a part of or acquired in connection with the performance of the work terminated by the notice of termination; and

b. The completed or partially completed plans, drawings, information, and other property to the work.

7. Use its best efforts to sell in the manner, at the times, to the extent, and at the prices directed or authorized by the Construction Manager, any property described in Section 6 of this paragraph, provided, however, that the Contractor shall not be required to extend credit to any buyer and further provided that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the County to the Contractor pursuant to this agreement.

8. Complete performance of such part of the work as shall not have been terminated by the notice of termination; and

9. Take such action as may be necessary, or as the Construction Manager may direct, for the protection and preservation of the property related to the agreement which is in the possession of the Contractor and in which the County has or may acquire an interest.

00700-45 RECORDS

The Contractor shall preserve and make available to the County all of its records, books, documents and other evidence bearing on the costs and expenses of the Contractor and any subcontractor pursuant to this agreement upon three days advance notice to the Contractor.

00700-46 DEDUCTIONS

In arriving at any amount due the Contractor pursuant to the terms of this agreement, there shall be deducted all liquidated damages, advance payments made to the Contractor applicable to the termination portion of the contract, the amount of any claim which the County may have against the Contractor, the amount determined by the Construction Manager to be necessary to protect the County against loss due to outstanding potential liens or claims, and the agreed price of any materials acquired or sold by the Contractor and not otherwise recovered by or credited to the County.

00700-47 REIMBURSEMENT OF THE COUNTY

In the event of termination, the Contractor shall refund to the County any amount paid by the County to the Contractor in excess of the costs properly reimbursable to the Contractor.

00700-48 SUSPENSION, INTERRUPTION, DELAY, DAMAGES

The Contractor shall be entitled to only those damages and that relief from termination by the County as specifically set forth in this agreement. The Construction Manager may issue a written order requiring the Contractor to suspend, delay or interrupt all or any part of the work for such period of time as the County may determine to be appropriate for the convenience of the County. If the performance of the work is interrupted for an unreasonable period of time by an act of the County or any of its officers, agents, employees, contractors, or consultants in the administration of this agreement, an equitable adjustment shall be made for any increase in the Contractor's costs of performance and any increase in the time required for performance of the work necessarily caused by the unreasonable suspension, delay, or interruption. Any equitable adjustment shall be reduced to writing and shall constitute a modification to this agreement. In

no event, however, shall an equitable adjustment be made to the extent that performance of this agreement would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of the Contractor. No claim for an equitable adjustment pursuant to this paragraph shall be permitted before the Contractor shall have notified the Construction Manager in writing of the act or failure to act involved, and no claim shall be allowed unless asserted in writing to the Construction Manager within ten days after the termination of such suspension, delay or interruption.

00700-49 COMMENCEMENT AND DURATION OF WORK

The County may issue a Notice to Proceed at any time within 120 days following execution of the contract by the County. The Contractor shall commence work pursuant to this agreement within ten days of mailing or delivery of written notice to proceed. The Contractor shall diligently prosecute the work to achieve Substantial Completion of the work and Final Completion within the time specified therefore in the Agreement. The capacity of the Contractor's construction and manufacturing equipment and plan, sequence and method of operation and forces employed, including management and supervisory personnel, shall be such as to insure completion of the work within the Contract Time specified in the Agreement. The Contractor and County hereby agree that the Contract Time for completion of the work is reasonable taking into consideration the average climatic conditions prevailing in the locality of the work and anticipated work schedules of other contractors whose activities are in conjunction with or may affect the work under this contract.

00700-50 TIME OF THE ESSENCE

All time limits stated in this agreement are of the essence of this contract.

00700-51 IMPACT DAMAGES

Except as specifically provided pursuant to a stop work order or change order, the Contractor shall not be entitled to payment or compensation of any kind from the County for direct or indirect or impact damages including, but not limited to, costs of acceleration arising because of delay, disruption, interference or hindrance from any cause whatsoever whether such delay, disruption, interference or hindrance is reasonable or unreasonable, foreseeable or unforeseeable, or avoidable, provided, however, that this provision shall not preclude the recovery of damages by the Contractor for hindrances or delays due solely to fraud or bad faith on the part of the County, its agents, or employees. The Contractor shall be entitled only to extensions in the time required for performance of the work as specifically provided in the contract.

00700-52 DELAY

The Contractor may be entitled to an extension of the Contract Time, but not an increase in the contract price or damages, for delays arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor or its subcontractors for labor strikes, acts of God, acts of the public enemy, acts of the state, federal or local government in its sovereign capacity, by acts of another separate contractor, or by an act or neglect of the County.

00700-53 INCLEMENT WEATHER

The Contractor shall not be entitled to an extension of the contract time due to normal inclement weather. Unless the Contractor can substantiate to the satisfaction of the Construction

Manager that there was greater than normal inclement weather and that such greater than normal inclement weather actually delayed the work, the Contractor shall not be entitled to an extension of time therefore. The following shall be considered the normal inclement weather days for each month listed, and extensions of time shall be granted in increments of not less than one half day only for inclement weather in excess of the days set out.

January	10 days
February	10 days
March	7 days
April	6 days
May	4 days
June	3 days
July	4 days
August	2 days
September	2 days
October	3 days
November	6 days
December	9 days

00700-54 DELAY - NOTICE AND CLAIM

The Contractor shall not receive an extension of time unless a Notice of Delay is filed with the Construction Manager within ten days of the first instance of such delay, disruption, interference or hindrance and a written Statement of the Claim is filed with the Construction Manager within 20 days of the first such instance. In the event that the Contractor fails to comply with this provision, it waives any claim which it may have for an extension of time pursuant to this agreement.

00700-55 STATEMENT OF CLAIM - CONTENTS

The Statement of Claim referenced in Article 00700-54 shall include specific information concerning the nature of the delay, the date of commencement of the delay, the construction activities affected by the delay, the person or organization responsible for the delay, the anticipated extent of the delay, and any recommended action to avoid or minimize the delay.

00700-56 WORK BEHIND SCHEDULE, REMEDY BY CONTRACTOR

If the work actually in place falls behind the currently updated and approved schedule, and it becomes apparent from the current schedule that work will not be completed within the contract time, the Contractor agrees that it will, as necessary, or as directed by the Construction Manager, take action at no additional cost to the County to improve the progress of the work, including increasing manpower, increasing the number of working hours per shift or shifts per working day, increasing the amount of equipment at the site, and any other measure reasonably required to complete the work in a timely fashion.

00700-57 DILIGENCE

The Contractor's failure to substantially comply with the requirements of the preceding paragraph may be grounds for determination by the County that the Contractor is failing to prosecute the work with such diligence as will insure its completion within the time specified. In such event, the County shall have the right to furnish, from its own forces or by contract, such additional labor and materials as may be required to comply with the schedule after 48 hours written notice to the Contractor, and the Contractor shall be liable for such costs incurred by the County.

00700-58 SET-OFFS

Any monies due to the Contractor pursuant to the preceding paragraph of this agreement may be deducted by the County against monies due from the County to the Contractor.

00700-59 REMEDIES CUMULATIVE

The remedies of the County under Articles 00700-56, 00700-57, and 00700-58 are in addition to and without prejudice to all of the rights and remedies of the County at law, in equity, or contained in this agreement.

00700-60 TITLE TO MATERIALS

No materials or supplies shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sales contract or other agreement by which any interest is retained by the seller. The Contractor hereby warrants that it has good and marketable title to all materials and supplies used by it in the work, and the Contractor further warrants that all materials and supplies shall be free from all liens, claims, or encumbrances at the time of incorporation in the work.

00700-61 INSPECTION OF MATERIALS

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards and in accordance with the requirements of the contract documents. Additional tests performed after the rejection of materials or equipment shall be at the Contractor's expense.

00700-62 CONSTRUCTION MANAGER'S PRESENCE DURING TESTING

All tests performed by the Contractor shall be witnessed by the Construction Manager unless the requirement therefore is waived in writing. The Construction Manager may perform additional tests on materials previously tested by the Contractor, and the Contractor shall furnish samples for this purpose as requested.

00700-63 MATERIALS INCORPORATED IN WORK

The Contractor shall furnish all materials and equipment to be incorporated in the work. All such materials or equipment shall be new and of the highest quality available. Manufactured materials and equipment shall be obtained from sources which are currently manufacturing such materials, except as otherwise specifically approved by the Construction Manager.

00700-64 STORAGE OF MATERIALS

Materials and equipment to be incorporated in the work shall be stored in such a manner as to preserve their quality and fitness for the work and to facilitate inspection.

00700-65 PAYROLL REPORTS

The Contractor may be required to furnish payroll reports to the Construction Manager as required by the Owner.

00700-66 CONTRACTORS' REPRESENTATIVE

Before beginning work, the Contractor shall notify the Construction Manager in writing of one person within its organization who shall have complete authority to supervise the work, receive orders from the Construction Manager, and represent the Contractor in all matters arising pursuant to this agreement. The Contractor shall not remove its representative without first designating in writing a new representative. The Contractor's representative shall normally be present at or about the site of work while the work is in progress. When neither the Contractor nor its representative is present at the work site, the superintendent, foreman, or other of the Contractor' employee in charge of the work shall be an authorized representative of the Contractor.

00700-67 SPECIALTY SUB-CONTRACTORS

The Contractor may utilize the services of specialty subcontractors on those parts of the project which, under normal contracting practices, are performed by specialty subcontractors. The Contractor shall not award more than seventy-five percent of the work to subcontractors.

00700-68 INSPECTION BY THE CONSTRUCTION MANAGER

All work pursuant to this agreement shall be subject to inspection by the Construction Manager for conformity with contract drawings and specifications. The Contractor shall give the Construction Manager reasonable advance notice of operations requiring special inspection of a portion of the work.

00700-69 WORK COVERED PRIOR TO CONSTRUCTION MANAGER'S INSPECTION

In the event that work is covered or completed without the approval of the Construction Manager, and such approval is required by the specifications or required in advance by the Construction Manager, the Contractor shall bear all costs involved in inspection notwithstanding conformance of such portion of the work to the contract drawings and specifications.

00700-70 SCHEDULING OF THE WORK

The work of this contract shall be planned, scheduled, executed, and reported as required by the Contract Documents.

00700-71 PROGRESS ESTIMATES

The Contractor shall prepare a written report for the Construction Manager's approval, on County forms, of the total value of work performed and materials and equipment obtained to the date of submission. Such a report must accompany each request for a progress payment and is subject to review and approval by the Construction Manager. Approval of a progress estimate or tendering of a progress payment shall not be considered an approval or acceptance of any work performed, and all estimates and payments shall be subject to correction in subsequent estimates. Progress payments shall be made for all completed activities and for materials suitably stored on-site.

00700-72 PROGRESS PAYMENTS

Upon approval of each monthly estimate of work performed and materials furnished, the Construction Manager shall approve payment to the Contractor for the estimated value of such work, materials, and equipment, less the amount of all prior payments and any liquidated damages. The Contractor will be paid 100 percent, less retainage, of the cost of materials received and properly stored on-site but not incorporated into the work. Payments for materials or equipment stored on the site shall be conditioned upon submission by the Contractor of bills of sale to establish the County's title to such materials or equipment. The Contractor's request for payment shall provide sufficient detail as to the work completed or materials purchased for which payment is requested to permit meaningful review by the Construction Manager.

00700-73 TIME OF PAYMENT

The Contractor will be paid within 45 days following receipt of an approved Progress Estimate. The Contractor expressly agrees that the payment provisions within this Contract shall supersede the rates of interest, payment periods, and contract and subcontract terms provided for under the Georgia Prompt Pay Act, O.C.G.A. §13-11-1 et seq., and that the rates of interest, payment periods, and contract and subcontract terms provided for under the Prompt Pay Act shall have no application to this Contract. The County shall not be liable for any late payment interest or penalty.

00700-74 RETAINAGE

The County shall retain from each progress payment ten percent of the estimated value of the work performed until the progress payments, including retainage, total 50 percent of the contract price. If a contract includes two or more projects or assignments that have been separately priced and have separate budgets, and the performances of such projects or assignments are not related to or dependent upon the performance of any other, the 50 per cent limit shall be based upon the price for each individual project or assignment. Thereafter, no further retainage shall be withheld so long as the Contractor is making satisfactory progress to insure completion of the work within the time specified therefore. The County may reinstate the ten percent retainage in the event the Construction Manager determines that the Contractor is not making satisfactory progress to complete the work within the time specified in this agreement or in the event that the Construction Manager provides a specific cause for such withholding. The County may also withhold retainage upon substantial completion of the work as provided in O.C.G.A. §13-10-81(c). Interest may be paid upon the retainage in accordance with Georgia law.

00700-75 PAYMENT OF SUBCONTRACTORS

The Contractor shall promptly pay each subcontractor upon the receipt of payment from the County. Such payment shall be made from the amount paid to the Contractor pursuant to the subcontractor's work. The Contractor shall also maintain the records of the percentage retained from payments to the Contractor pursuant to such subcontractor's work. The Contractor shall procure agreements from each subcontractor requiring each subcontractor to pay their subcontractors, agents and employees in a similar manner. The County reserves the right to inquire of any subcontractor, supplier, materialmen, or subconsultant, the status of any indebtedness of the Contractor. The County further reserves the right to require the Contractor to designate on each instrument of payment exceeding $400.00 to subcontractors, suppliers, materialmen, and subconsultants that such payment is on account of the work under this Contract.

00700-76 COUNTY'S RESPONSIBILITIES TO SUBCONTRACTORS

Neither the County nor the Construction Manager shall have any obligation to pay any subcontractor except as otherwise required by law.

00700-77 PROGRESS PAYMENTS - ACCEPTANCE OF WORK

Certification of progress payments, as well as the actual payment thereof, shall not constitute the County’s acceptance of work performed pursuant to this agreement.

00700-78 PAYMENTS IN TRUST

All sums paid to the Contractor pursuant to this agreement are hereby declared to constitute trust funds in the hands of the contractor to be applied first to the payment of claims of subcontractors, laborers, and suppliers arising out of the work, to claims for utilities furnished and taxes imposed, and to the payment of premiums on surety and other bonds and on insurance for any other application.

00700-79 JOINT PAYMENTS

The County reserves the right to issue any progress payment or final payment by check jointly to the Contractor and any subcontractor or supplier.

00700-80 RIGHT TO WITHHOLD PAYMENT

The Construction Manager may decline to approve payment and may withhold payment in whole or in part to the extent reasonable and necessary to protect the County against loss due to defective work, probable or actual third party claims, the Contractor's failure to pay subcontractors or materialmen, reasonable evidence that the work will not be completed within the contract time or contract price or damage to the County or any other contractor on the project.

00700-81 CERTIFICATE OF SUBSTANTIAL COMPLETION

Upon the Contractor's submission of a request for a certificate of Substantial Completion, the Construction Manager shall inspect the work and determine whether the work is Substantially Complete. If the work is Substantially Complete, the Construction Manager shall issue a

certificate of Substantial Completion of the work which shall establish the date of Substantial Completion, shall state the responsibilities of the County and the Contractor for security, maintenance, heat, utilities, damage to the work and insurance, and shall fix the time within which the Contractor shall complete the items submitted by the Contractor as requiring correction or further work. The certificate of substantial completion of the work shall be submitted to the County and the Contractor for their written acceptance of the responsibilities assigned to them pursuant to such certificate.

If in the sole opinion of the Construction Manager, the work is not substantially complete, the Construction Manager shall notify the Contractor of such, in writing, and outline requirements to be met to achieve Substantial Completion.

00700-82 PAYMENT UPON SUBSTANTIAL COMPLETION

Upon Substantial Completion of the work and upon application by the Contractor and approval by the Construction Manager, the County shall make payment reflecting 100% work completed, less value of work remaining as determined by Construction Manager and any authorized retainage.

00700-83 COMMENCEMENT OF WARRANTIES

Warranties required by this agreement shall commence on the date of final completion of the project as determined under Article 00700-84 unless otherwise provided in the certificate of Substantial Completion.

00700-84 FINAL PAYMENT - WAIVER OF CLAIMS, DISPUTE OF FINAL PAYMENT

The acceptance of the Substantial Completion payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of application for payment at Substantial Completion and except for the retainage sums due at final acceptance. Following the Construction Manager's issuance of the certificate of Substantial Completion and the Contractor's completion of the work pursuant to this agreement, the Contractor shall forward to the Construction Manager a written notice that the work is ready for final inspection and acceptance. If after inspection the Construction Manager certifies that the work is complete and issues written notification of such to the Contractor, the Contractor shall forward to the Construction Manager a final application for payment. The Construction Manager shall issue a certificate for payment, which shall approve final payment to the Contractor and shall establish the date of final completion.

In the event the Contractor timely disputes the amount of the final payment, the amount due the Contractor shall be deemed by the Contractor and the County to be an unliquidated sum and no interest shall accrue or be payable on the sum finally determined to be due to the Contractor for any period prior to final determination of such sum, whether such determination be by agreement of the Contractor and the County or by final judgment of the proper court in the event of litigation between the County and the Contractor. The Contractor specifically waives and renounces any and all rights it may have under O.C.G.A. §13-6-13 and agrees that in the event suit is brought by the Contractor against the County for any sum claimed by the Contractor under the Contract or for any extra or additional work, no interest shall be awarded on any sum found to be due from the County to the Contractor in the final judgment entered in such suit. All final judgments shall draw interest at the legal rate, as specified by law.

00700-85 DOCUMENTATION OF COMPLETION OF WORK

Neither the final payment nor the remaining retainage shall become due until the Contractor submits the following documents to the Construction Manager:

a. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work have been paid other otherwise satisfied;

b. The surety's consent to final payment; and

c. Any other data reasonably required by the County or Construction Manager establishing payment or satisfaction of all such obligations, including releases, waivers of liens, and documents of satisfaction of debts.

In the event that a subcontractor refuses to furnish a release or waiver as required by the County or Construction Manager, the Contractor may furnish a bond satisfactory to the County to indemnify the County against such loss. In the event that any lien or indebtedness remains unsatisfied after all payments are made, the contractor shall refund to the County all moneys that the County may become compelled to pay in discharging such lien or other indebtedness, including all costs and reasonable attorney's fees.

00700-86 GOVERNING LAW

Each and every provision of this agreement shall be construed in accordance with and governed by Georgia law. The parties acknowledge that this contract is executed in Fulton County, Georgia and that the contract is to be performed in Fulton County, Georgia. Each party hereby consents to the Fulton Superior Court's sole jurisdiction over any dispute which arises as a result of the execution or performance of this agreement, and each party hereby waives any and all objections to venue in the Fulton Superior Court.

00700-87 CHANGES IN THE WORK

A. CHANGE ORDERS

1. A Change Order is a written order to the Contractor signed to show the approval and the authorization of the County, issued after execution of the Contract, authorizing a change in the Work and/or an adjustment in the Contract Sum or the Contract Time. Change Orders shall be written using forms designated by the County with Contractor providing supporting documentation as required by the Construction Manager. The Contract Sum and the Contract Time may be changed only by approved Change Order pursuant to Fulton County Procedure 800-6. The amount payable by the Change Order is payment in full for all direct and indirect costs incurred and related to the work under said Change Order, including but not limited to delays, imports, acceleration, disruption and extended overhead. A Change Order signed by the Contractor indicates the Contractor's agreement therewith, including the adjustment in either or both of the Contract Sum or the Contract Time.

2. The County, without invalidating the Contract, may order changes in the Work within the general scope of the Contract as defined herein. The time allowed for performance of the work and the contract price to be paid to the Contractor may be adjusted accordingly.

3. The cost or credit to the County resulting from a change in the Work shall be determined in one or more of the following ways:

a. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

b. By unit prices stated in the Contract Documents or subsequently agreed upon;

c. By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

d. By the method provided in Subparagraph A4 below.

4. If none of the methods set forth in Subparagraphs 3a, 3b, or 3c above is agreed upon, the Contractor, provided a written order signed by the Construction Manager is received, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the Construction Manager on basis of the reasonable expenditures and savings of those performing the Work attributable to the change. The cost of the change shall include only the items listed in Subparagraph 5a below, and in the case of either a decrease or an increase in the Contract Sum, an allowance for overhead and profit in accordance with the schedules set forth in Subparagraphs 5b and 6 below shall be applied to the cost or credit.

a. In such case, and also under Subparagraph 3a above, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting of all actual costs expended, together with appropriate supporting data for inclusion in a Change Order.

b. All hourly rate charges shall b submitted to the Construction Manager for prior review and approval. All hourly rate charges shall be properly supported as required by the Construction Manager with certified payrolls, or their acceptable equivalent. When authorized to proceed for a given change and actual expenditures have been made prior to execution of a Change Order for the entire change, such actual expenditures may be summarized monthly, and if approved, incorporated into a Change Order. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase or decrease, if any, with respect to that change.

5. In Subparagraphs 3 and 4 above, the items included in “Cost and “Overhead” shall be based on the following schedule:

a. Unless otherwise provided in the Contract Documents, “Cost” shall be limited to the following: cost of materials incorporated into the Work, including sales tax and cost of delivery; cost of direct labor (labor cost may include a pro rata share of foreman’s account of the change) including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; workers’ or workmen’s compensation insurance; rental value of equipment and machinery; costs for preparing Shop Drawings.

b. Unless otherwise provided in the Contract Documents, “Overhead” shall include the following: bond and insurance premiums including increase and decreases from change in the Work, supervision, superintendence, construction parking, wages of timekeepers, watchmen and clerks, small

tools, consumable supplies, expendables, incidentals, general office expense, the cost of additional reproduction for the Contractor's subcontractors beyond that agreed upon in the Contract Documents, construction parking, any additional costs of craft supervision by the Contractor's or subcontractors' superintendents, and overhead charges which would be customary and expended regardless of the change in the Work due to other overlapping activities which are included as part of the original Contract, and all other expenses not included in "Cost" above.

c. In the event that a change is issued by the County which would require the expenditure of substantial amounts of special supervision (beyond the foreman level) by the Contractor, the Contractor may, at the sole direction of the Construction Manager, be allowed to incorporate these charges into the agreement cost for the change.

6. In Subparagraphs 3 and 4 above, the allowance for overhead and profit combined, included in the total cost or credit to the County, shall be based on the following schedule:

a. For the Contractor, for any work performed by the Contractor's own forces, <u>ten (10) percent</u> of the cost.

b. For the Contractor, for any work performed by a Contractor's subcontractor, five (5) percent of the amount due the subcontractor.

c. For each subcontractor or sub-subcontractor involved, for any work performed by that subcontractor's or sub-subcontractor's own forces, ten (10) percent of the cost.

d. For each subcontractor, for work performed by a sub-subcontractor, five (5) percent of the amount due to the sub-subcontractor.

e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 5 above unless modified otherwise.

7. In order to facilitate checking of quotations for extras or credits, all proposals or bids, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs, including labor cost, materials and subcontracts. Labor and materials shall be itemized in the manner defined in Subparagraph 4 above. Where major cost items are subcontracts, they shall be itemized also. <u>In no case shall a change be approved without such itemization</u>.

8. No payment shall be made for any changes to the contract that are not included in a fully executed Change Order.

B. CONCEALED, UNKNOWN AND DIFFERING CONDITIONS

1. Should concealed conditions be encountered in the performance of the Work below the surface of the ground, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Contract Documents, or should unknown physical conditions below the surface of the ground or concealed or unknown conditions in an existing structure of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, be encountered, the Contract Sum and Contract Time shall be equitably adjusted by Change Order upon request by either party made **<u>within twenty (20) days after</u>**

<u>the first observance</u> of the conditions. No such request for equitable adjustment shall be valid unless the Contractor complies with this (20) days notice and Subparagraph C.1. below.

2. The Contractor shall promptly, and before such conditions are disturbed, notify the Construction Manager in writing of any claim of concealed, unknown or differing conditions pursuant to this paragraph. The Construction Manager shall authorize the Engineer to investigate the conditions, and if it is found that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be recommended to the Construction Manager.

3. No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above, prior to disturbing the condition.

4. No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this Contract.

5. Any materially differing site condition as between what is shown on the Drawings and Specifications and actually found on site shall be immediately reported to the Construction Manager in writing prior to the commencement of Work at the site. Failure of the Contractor to notify the Construction Manager in writing of the differing site condition prior to performance of Work at the site shall constitute a waiver of any claim for additional monies. Any Change Order necessitated by the differing site condition shall be processed as provided under "Changes in the Contract".

C. REQUESTS FOR ADDITIONAL COST

1. If the Contractor wishes to request an increase in the Contract Sum, the Contractor shall give the Construction Manager written notice thereof within twenty (20) days after the occurrence of the event, or identification of the conditions, giving rise to such request. This notice shall be give by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Article 00700-25 and Subparagraph A.4 above. No such request shall be valid unless so made within the twenty (20) days specified above. If the County and the Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined by the Construction Manager. Any change in the Contract Sum resulting from such claim shall be documented by Change Order.

2. If the Contractor claims that addition cost is involved because of, but not limited to (1) any written interpretation pursuant to General Condition 00700-17 of this Agreement, (2) any order by the County to stop the Work pursuant to Articles 00700-25 and 00700-37 of this Agreement where the Contractor was not at fault, or any such order by the Construction Manager as the County’s agent, or (3) any written order for a minor change in the Work issued pursuant to Paragraph D below, the Contractor shall submit a request for an increase in the Contract Sum as provided in Subparagraph C.1 above. No such claim shall be valid unless the Contractor complies with Subparagraph C.1 above and approved by the County pursuant to Change Order Policy 800-6.

D. MINOR CHANGES IN THE WORK

The Construction Manager may order minor changes in the Work not involving an adjustment in the Contract Price, extension of the time allowed for performance of the work and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by a written Change Directive issued by the Construction Manager, and shall be binding on the County and the Contractor. The Contractor shall carry out such written orders promptly.

E. BONDS

If any change order results in an increase in the contract price, the contractor shall increase the penal sum of the performance and payment bonds to equal the increased price.

00700-88 DISAGREEMENT WITH ORDERS FOR CHANGE

Contractor's written acceptance of a Change Order or other order for changes shall constitute his final and binding agreement to the provisions thereof and a waiver of all claims in connection therewith, whether direct or consequential in nature. Should Contractor disagree with any order for changes, he may submit a notice of potential claim to the Construction Manager, at such time as the order is set forth in the form of a Change Order. Disagreement with the provisions of an order for changes shall not relieve Contractor of his obligation under Article 00700-87 of this Agreement.

00700-89 NO WAIVER OF REMEDIES

Exercise by the County of any remedy is not exclusive of any other remedy available to County and shall not constitute a waiver of any such other remedies. Failure of the County to exercise any remedy, including breach of contract remedies, shall not preclude the County from exercising such remedies in similar circumstances in the future.

00700-90 LAND AND RIGHTS-OF-WAY

The owner will provide, as indicated in the Contract Documents and prior to Notice to Proceed, the lands upon which the work is to be done, right-of-way for access thereto, and such other lands which are designated for the use of the Contractor. The Contractor shall confine the Contractor's work and all associated activities to the easements and other areas designated for the Contractor's use. The Contractor shall comply with any limits on construction methods and practices which may be required by easement agreements. If, due to some unforeseen reason, the necessary easements are not obtained, the Contractor shall receive an equitable extension of contract time dependent upon the effect on the critical path of the project schedule or the County may terminate the Contract for its convenience.

00700-91 COORDINATION WITH STATE DEPARTMENT OF TRANSPORTATION

No clearing or grading shall be completed by Contractor within the State Department of Transportation (DOT) area under construction. The Contractor must coordinate his construction scheduling with DOT.

If the Contractor begins work before DOT's completion date, he must obtain the approval of DOT before starting work in the area. The state DOT has the right to stop the Contractor's work the DOT area.

The Contractor shall receive no additional compensation or damages resulting from delay or work stoppage from DOT actions or scheduling.

Contractor shall obtain DOT drawings of the DOT, project area for verification of road geometry, storm drains, etc. from Georgia Department of Transportation or Fulton County. The Contractor is responsible for obtaining any pertinent DOT revisions.

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EXHIBIT A

FINAL AFFIDAVIT

TO FULTON COUNTY, GEORGIA

I, _____, hereby certify that all suppliers of materials, equipment and service, subcontractors, mechanic, and laborers employed by _____ or any of his subcontractors in connection with the design and/or construction of _____ at Fulton County have been paid and satisfied in full as of _____, 200___, and that there are no outstanding obligations or claims of any kind for the payment of which Fulton County on the above-named project might be liable, or subject to, in any lawful proceeding at law or in equity.

_____

Signature

_____

Title

Personally appeared before me this _____ day of _____, 20_____. _____, who under Oath deposes and says that he is _____of the firm of _____, that he has read the above statement and that to the best of his knowledge and belief same is an exact true statement.

_____

Notary Public

_____

My Commission expires

END OF SECTION

SECTION 01 00 00
GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The Project consists of the following major elements: replacement of twelve dry pit pumps (three per station) with dry pit submersible pumps, piping and valve replacement, MCC replacement, replacement of four existing diesel backup generators with four new diesel backup generators, installation of four new flow meters and meter vaults and installation of a new pumping bypass system at each station.

1.3 GENERAL REQUIREMENTS

A. Prior to commencement of Work, the Contractor shall review the construction site with the Owner's representative to make permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage. This record shall serve as a basis for determination of subsequent damage to the structures and adjacent areas due to Contractor's operations. Any damage to these structures and adjacent areas not noted in original review record shall be reported immediately to Owner. Permanent record shall include photographs and/or video graphic recording.

B. Smoking and Fire Precautions: No smoking, fire, or use of any fire- or explosion- producing tools or equipment will be permitted on the premises or at any locations where such may endanger said premises or the current operations thereon.

C. Manufacturers Qualifications: The manufacturers of all materials and equipment used must be approved by the Engineer and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

D. Compliance with state and local laws: Comply will all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

E. Protection of public and private property: The Contractor shall be responsible for preservation of and shall take special care in working areas to protect public and private property. The Contractor shall replace or repair at his own expense any damaged water pipes, power and communication lines, or other public utilities, roads, curbs, gutters, sidewalks, drain pipes, drainage ditches, all properties and fixtures

(both permanent and temporary), and all plantings, including grass or sod on the site of the work. Leave the site in original or better condition after all cleanup work has been done.

F. Markers: Preserve all surveyed and privately owned markers and monuments; do not remove or disturb any such markers without prior approval from the Owner of the marker. Any removal and replacement of such markers shall be at the expense of the Contractor.

G. Approved Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with manufacturer's instructions.

H. Catalog Data for Owners: Provide duplicate complete, bound sets of a compilation of catalog data of each manufactured item of mechanical and electrical equipment used in the Work, for transmittal to the Owner before payment of more than ninety percent (90%) is made. Include descriptive data and printed installation, operating, and maintenance instructions (including a parts list for each item of equipment). Provide a complete double index as follows:

1. List the products alphabetically by name.
2. List alphabetically the names of manufacturers whose products have been incorporated in the work, together with their addresses and the names and addresses of the local sales representative.

I. Installation, Testing and Guarantee: Install all materials and equipment exactly in accordance with the manufacturer's recommendations. The completely installed system shall be guaranteed against any and all defects of manufacture, materials, workmanship, or installation for a period of one year from the date of Substantial Completion.

J. Operation and Maintenance of the Systems and Instruction to Owner: Where the specifications for equipment require that a factory service representative provide operation and maintenance instruction to the Owner for that equipment, this service shall be performed by prior arrangement with the Owner after and in addition to the manufacturer's instructions to the Contractor for installation and start-up. The individual performing the instructions to the Owner is to be trained and/or certified by the manufacturer as its authorized operation, maintenance, and service specialist. If the said specialist is not a regular, full-time employee of the manufacturer, the specialist's qualifications shall be submitted to the Owner for review and approval prior to scheduling the site visit for instructions to the Owner.

K. Drawings of Record: Provide and keep up-to-date a complete record set of drawings, which shall be corrected daily to show every change. Keep this set of prints at the job site, and use only as a record set. This shall not be construed as authorization for the Contractor to make changes in the approved layout without definite instructions in each case. Turn the set over to the Owner upon completion of the project.

L. Existing Utilities: The Contractor is to notify the Owner of all underground utilities no less than two days in advance of proposed utility

interruption before beginning construction in the area. The Contractor is responsible for locating all existing utilities prior to construction and shall carefully protect from damage all utilities in the vicinity of the work at all times. The Contractor shall be responsible for repairing any utilities that were properly located and marked. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules, regulations, and approval of the particular utility involved. Any such work shall be considered incidental to the construction or repairs of utility lines, and no additional payment will be allowed therefore. Existing utilities shall remain in service at all times during construction. Contractor shall provide any temporary piping necessary to maintain utility service to existing customers.

M. The Contractor shall maintain access to the pump station at all times.

N. Inspection of Work: The Contractor shall provide full access to the project site at all times for inspection and observation of Work by the Owner, Engineer, and agents of any local, state, or federal agency having jurisdiction.

O. Flood Insurance: The Contractor is required to carry flood insurance for Work which is located in designated flood hazard areas unless insurance is not available.

PART 2 **-** PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 OPERATION OF EXISTING UTILITIES

A. The Work shall be performed so as to cause minimum interference or interruption with the normal operation of the existing utilities. The Contractor shall plan and conduct construction sequencing operations to avoid disturbing existing utilities and equipment, except as may be provided or approved by the Engineer. Contractor shall provide emergency power and/or bypass pumping, if necessary, to maintain operations at all times during construction.

END OF SECTION

SECTION 01 10 00
SUMMARY OF WORK

PART 1 - GENERAL

1.9 LOCATION OF WORK

B. The work under this Contract is located at the Sullivan Wastewater Pump Stations #1 through #4, located in Sandy Springs, Georgia. All of these facilities are owned by the Fulton County Water Resources Department.

5. Sullivan Wastewater Pump Station #1 is located at 8345 Grogans Ferry Road, Sandy Springs, Georgia.

6. Sullivan Wastewater Pump Station #2 is located at 155 Grogans Landing, Sandy Springs, Georgia.

7. Sullivan Wastewater Pump Station #3 is located at 2700 Harbor Pointe Parkway, Sandy Springs, Georgia.

8. Sullivan Wastewater Pump Station #4 is located at 2300 Spring Creek Lane, Sandy Springs, Georgia

1.10 GENERAL SCOPE OF WORK

C. Furnish all labor, materials, equipment, and incidentals necessary to perform the Work, upgrade the pumps stations and make them ready for operation as shown on the Drawings and specified herein.

D. Major areas of the Work include, but are not necessarily limited to, the following items:

3. Prepare the Sullivan Wastewater Pump Stations sites for use including:

h. Construction of access roadway to the site.

i. Removal and replacement of existing dry pit submersible pumps, piping and related appurtenances

j. Upgrade of electrical power system.

k. Implementation of odor control system.

l. Establish and install erosion and sediment control.

m. Replacement of the existing diesel backup generator with new generator.

n. Installation of a new bypass and flow meter system.

4. Site demobilization and site restoration, as required.

1.11 SCOPE OF WORK FOR PUMPING STATIONS

C. The Work includes, but is not necessarily limited to, the following major items:

5. Removal and replacement of existing dry pit submersible pumps, piping and related appurtenances.
6. Electrical, instrumentation and controls wiring.
7. Installation of emergency bypass pumping system.
8. Restoration and revegetation of the site.

D. Special considerations:

2. The Contractor shall ensure that necessary precautions are taken to maintain functionality and operation of pump station(s) during construction.

1.12 ACCESS TO SITE

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

23. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
24. Limits: Confine construction operations to areas of work shown in Plans.
25. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
26. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
27. Owner Occupancy: Allow for Owner occupancy of Project site.
28. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
29. Schedule deliveries to minimize use of driveways and entrances by construction operations.
30. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
31. Do not unreasonably encumber site with equipment, materials, or vehicles.
32. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed, to conditions which existed previous to starting performance under the Contract.
33. Parking for construction personnel including the use of Owner’s site(s) shall be reviewed with Owner before construction start.

34. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
35. Limit use and operation within existing facilities to areas indicated for construction work and as required to perform Work. Other areas within facility shall not be disturbed or disrupted.
36. Perform Work so as not to interfere or inconvenience staff and Owner’s operation.
37. Maintain and keep clear all required fire exit ways throughout facility within and in vicinity of construction areas. Coordinate alternate temporary egress routes with Owner and local fire authority.
38. Do not load structure with weights that will endanger structure.
39. Smoking is absolutely prohibited within facilities or on Owner’s property.
40. Audio devices and radios are prohibited; except that two-way radios, and their use within occupied facilities shall be limited so not to disrupt occupants.
41. T-shirts or other clothing with derogatory depictions, language, and/or slogans regarding alcohol, drugs, race or sexual in nature, shall not be worn on premises.
42. Derogatory language regarding race, sexual or religious in nature, shall not be used on premises.
43. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

44. Make every effort to keep noise to a minimum in construction operation. Jackhammers shall not be permitted for use within the existing building without the Owner's consent.

1.13 COORDINATION WITH OPERATIONS STAFF AND CONTRACTOR

J. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

K. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

L. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

M. Contractor and his forces shall exercise special care during all aspects of construction activity including material deliveries, hoisting and installation activities.

N. Control of traffic, dust, dirt, and construction related noise shall be maintained at all times.

O. Schedule work at such time and in such a manner so as to minimize interference and inconvenience to staff and Owner's operations.

P. Each Contractor must obtain authorization of General Contractor as approved by Owner, before starting any work within an existing area of building.

Q. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.

R. Work shall be performed in a manner that will not impose avoidable hardship, danger, or inconvenience to staff.

1.14 WORK RESTRICTIONS

B. Work Restrictions, General: Comply with restrictions on construction operations.

10. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

11. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
    a. Notify Engineer and Owner not less than two days in advance of proposed utility interruptions.
    b. Obtain Owner's written permission before proceeding with utility interruptions.

12. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

13. Notify Engineer and Owner not less than two days in advance of proposed disruptive operations.

14. Obtain Owner's written permission before proceeding with disruptive operations.

15. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

16. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

17. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

18. Maintain list of approved screened personnel with Owner's representative.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

C. Project Manual: The Project Manual comprises written documents for the Work that include Specifications issued under the professional seals of the Engineer and its consultants, and documents prepared by the Owner or other entities for which the Engineer has no responsibility. The Project Manual may contain documents such as bidding requirements and information available to bidders that are not Contract Documents.

D. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
Specification requirements are to be performed by Contractor unless specifically stated otherwise.

5. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

6. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

7. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

8. Abbreviations: Materials and products are identified by industry standard abbreviations and as scheduled on Drawings.

1.16 MISCELLANEOUS PROVISIONS

B. By execution of this Contract, Contractor acknowledges review of proposed details and specifications and agrees to provide warranties and bonds for products and systems specified herein, detailed on drawings and as approved as a substituted or comparable product or system in accordance with Division 01 Section "Product Requirements".

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

Unit Price Schedule: An itemized list of additional work directives as the result of a Change Order. The schedule provides a unit cost for the identified work task.

Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

Stored Materials: Product values that may be claimed on an Application for Payment. Product invoices must be provided with Application for Payment to substantiate the value of the Stored Materials claim. Stored Materials are associated with portions of the work that are represented by Bid Form or Schedule of Values line items and will be limited on the Application for Payment to a maximum of 30 percent of the total amount bid. Deviations to this standard shall be as approved by the Owner and Construction Manager. The Stored Materials value will be reduced on each Application for Payment based on the total contract value complete to date of said Application for Payment. The Stored Materials value will be reduced to zero upon original Substantial Completion date.

1.4 SCHEDULE OF VALUES

Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

Application for Payment forms with Continuation Sheets.

A. Submittals Schedule.

Submit the Schedule of Values to Construction Manager at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. When deemed

necessary, the Construction Manager will provide the Contractor with a Schedule of Values list. Provide at least one line item for each Specification Section.

C. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

1. Description of the Work.
2. Change Orders (numbers) that affect value.
3. Dollar value.
4. Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

D. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

E. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

F. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

G. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

H. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

I. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

J. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Amount.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Construction Manager and paid for by Owner.

B. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment have individual requirements.

C. Payment Application Times: The closing date for each progress payment shall be established at the pre-construction conference. The period covered by each Application for Payment starts on the day following the end of the preceding application period.

D. Payment Application Forms: Use Contractor’s Application for Payment (EJCDC Document C-620), or equivalent approved form.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

F. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

G. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

H. Include Stored Materials values, as applicable.

I. Transmittal: Submit 5 signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.

K. Applications for Payment: The Construction Manager encourages a draft application for payment be submitted for review and comment. Contractor will address the comments and then submit a signed application for payment for review and approval. Comments made by the Construction Manager are generally needed to correct minor, infrequent typographical errors, mathematical errors, etc. If the signed application for payment has sufficient errors to required a second revision, the Owner will deduct the amount of the Construction Manager's compensation for the second revision and subsequent revisions from the final payment to the Contractor as provided on the Bid Form.

L. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

M. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

Evidence of completion of Project closeout requirements.

Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

Updated final statement, accounting for final changes to the Contract Sum.

AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

AIA Document G706A, "Contractor's Affidavit of Release of Liens."

AIA Document G707, "Consent of Surety to Final Payment."

Evidence that claims have been settled.

Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Information (RFIs).

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

B. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

C. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.

D. Make adequate provisions to accommodate items scheduled for later installation.

E. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

F. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

G. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

H. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

I. Communication Procedures: The Owner and Contractor shall communicate with each other through the Engineer about matters related to the Contract, unless otherwise provided in the Contract Documents or when direct communications have been specially authorized. Communications by and with the Engineer's consultants shall be through the Engineer. Communications by and with subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

1.5 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

B. Attendees: Inform participants and others involved, and individuals whose presence is required, in writing seven working days prior to each meeting, of date and time of meeting. Notify Owner and Engineer of scheduled meeting dates and times.

C. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

D. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Representative, and Engineer, within three days of the meeting.

E. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Representative, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

F. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

G. Agenda: Discuss items of significance that could affect progress, including the following:

1. Tentative construction schedule.
2. Phasing.
3. Critical work sequencing and long-lead items.
4. Designation of key personnel and their duties.
5. Procedures for processing field decisions, Proposal Requests and Change Orders.
6. Procedures for RFIs.
7. Procedures for testing and inspecting.
8. Procedures for processing Applications for Payment.
9. Distribution of the Contract Documents.
10. Submittal procedures.
11. Procedures for Maintaining and Preparation of Record Documents.
12. Use of the premises and existing building.
13. Work restrictions.
14. Owner's occupancy requirements.
15. Responsibility for temporary facilities, utilities and controls.
16. Construction waste management and recycling.
17. Parking availability.
18. Office, work, and storage areas.
19. Equipment deliveries and priorities.
20. First aid.
21. Security.
22. Progress cleaning.
23. Working hours.
24. Infection Control Risk Assessment (IRCA).

H. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

I. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

J. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

K. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

L. Review schedule for next period.

M. Review present and future needs of each entity present, including the following:

1. Interface requirements.
2. Sequence of operations.
3. Status of submittals.
4. Deliveries.
5. Off-site fabrication.
6. Access.
7. Site utilization.
8. Temporary facilities and controls.
9. Work hours.
10. Hazards and risks.
11. Progress cleaning.
12. Quality and work standards.
13. Status of correction of deficient items.
14. Field observations.
15. RFIs.
16. Status of proposal requests.
17. Pending changes.
18. Status of Change Orders.
19. Pending claims and disputes.
20. Documentation of information for payment requests.

N. Minutes: Engineer will record and distribute to Contractor the meeting minutes.

O. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

P. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. Procedure: Immediately on discovery of the need for information of the Contract Documents, and if not possible to request information at Project meeting, prepare and submit an RFI in the form specified.

B. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

C. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

D. Submittal of an RFI constitutes representation that the Contractor requires additional information about the Contract Documents AFTER he has made careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, and prior project correspondence or documentation.

E. If upon evaluation of the RFI the Engineer finds that the requested information is contained in the Contract Documents or by other documents and/or methods as outlined in paragraph above, the Owner has the option to obtain reimbursement from the Contractor for costs incurred by the Owner for the Engineer's services and expenses made necessary in answering such requests.

F. Content of the RFI: Include a detailed, legible description of item needing information and the following:

1. Project name.
2. Date submitted to the Engineer.
3. Name of Contractor.
4. Name of Engineer and Construction Manager.
5. RFI number, numbered sequentially by the Contractor as they are submitted to the Engineer.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Discipline (Architecture, Structural, Mechanical, Electrical, etc.).
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.

G. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

H. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

I. Date information required.

J. Hard-Copy RFIs: Form at end of this Section.

K. Identify each page of attachments with the RFI number and sequential page number.

L. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

M. Attachments shall be electronic files in Adobe Acrobat PDF format.

N. Engineer's and Construction Manager's Action: Engineer and Construction Manager will review each RFI, determine action required, and return it. Allow three working days for Engineer's response for each RFI. RFIs received after 2:00 p.m. local time will be considered as received the following working day.

O. If the date of response requested is less than 3 working days, the Engineer will endeavor to respond when requested, however a failure to respond prior to the requested date shall not be the sole basis for any delay claims of time or money.

P. The following RFIs will be returned without action:
1. Requests for approval of submittals.
2. Requests for approval of substitutions.
3. Requests for coordination information already indicated in the Contract Documents.
4. Requests for adjustments in the Contract Time or the Contract Sum.
5. Requests for interpretation of Engineer's actions on submittals.
6. Incomplete RFIs or RFIs with numerous errors.

Q. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.

R. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

S. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer and Construction Manager in writing within 5 working days of receipt of the RFI response.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.
8. Safety reports if any.

1.3 DEFINITIONS

Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.

Predecessor Activity: An activity that precedes another activity in the network.

Successor Activity: An activity that follows another activity in the network.

Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Engineer.

CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

Event: The starting or ending point of an activity.

Float: The measure of leeway in starting and completing an activity.

Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

PDF electronic file.

B. Startup construction schedule.

Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

F. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

G. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

H. Total Float Report: List of all activities sorted in ascending order of total float.

I. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

J. Construction Schedule Updating Reports: Submit with Applications for Payment.

K. Daily Construction Reports: Submit at weekly intervals.

L. Material Location Reports: Submit at weekly intervals.

M. Site Condition Reports: Submit at time of discovery of differing conditions.

N. Special Reports: Submit at time of unusual event.

O. Qualification Data: For scheduling consultant.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

C. Secure time commitments for performing critical elements of the Work from entities involved.

D. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

Activity Duration: Define activities so no activity is longer than 10 days, unless specifically allowed by Owner.

Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement

cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

Startup and Testing Time: Include no fewer than 3 days for startup and testing.

Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Owner or Representative's administrative procedures necessary for certification of Substantial Completion.

Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

Phasing: Arrange list of activities on schedule by phase.

Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

See Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

- Unresolved issues.
- Unanswered Requests for Information.
- Rejected or unreturned submittals.
- Notations on returned submittals.
- Pending modifications affecting the Work and Contract Time.

Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours,

working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

C. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

List of subcontractors at Project site.
List of separate contractors at Project site.
Approximate count of personnel at Project site.
Equipment at Project site.
Material deliveries.
High and low temperatures and general weather conditions, including presence of rain or snow.
Accidents.
Meetings and significant decisions.
Unusual events (see special reports).
Stoppages, delays, shortages, and losses.
Meter readings and similar recordings.
Emergency procedures.
Orders and requests of authorities having jurisdiction.
Change Orders received and implemented.
Work Change Directives received and implemented.
Services connected and disconnected.
Equipment or system tests and startups.
Partial completions and occupancies.
Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

Material stored prior to previous report and remaining in storage.

Material stored prior to previous report and since removed from storage and installed.
Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule two days before each regularly scheduled progress meeting.

B. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

C. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

D. As the Work progresses, indicate final completion percentage for each activity.

E. Distribution: Distribute copies of approved schedule to Engineer, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

F. Post copies in Project meeting rooms and temporary field offices.

G. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
Preconstruction photographs.
Periodic construction photographs.
Final completion construction photographs.
Preconstruction video recordings.
Periodic construction video recordings.

B. Related Requirements:
1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs. A minimum of (15) fifteen image files with monthly pay applications.
B. Digital Camera: Minimum sensor resolution of 8 megapixels.
C. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
D. Video Recordings: Submit video recordings within seven days of recording. Submit preconstruction video and pictures with first pay application.
E. Submit video recordings in digital video disc format acceptable to Engineer.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Engineer.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

B. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Date and Time: Include date and time in file name for each image.

E. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer and Owner.

F. Preconstruction Photographs: Starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner or Representative.

G. Flag construction limits before taking construction photographs.

H. Take 20 photographs to show existing conditions adjacent to property before starting the Work.

I. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

J. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

K. Periodic Construction Photographs: Take photographs at regular intervals through out construction. Select vantage points to show status of construction and progress since last photographs were taken. Include readable photographs of all equipment nameplates.

L. Engineer and Owner-Directed Construction Photographs: From time to time, Engineer and Owner may instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

M. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Owner or Representative will inform photographer of desired vantage points.

N. Additional Photographs: Owner or Representative may request photographs, in addition to periodic photographs specified. Additional photographs are included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.

O. Circumstances that could require additional photographs include, but are not limited to, the following:

1. Immediate follow-up when on-site events result in construction damage or losses.
2. Substantial Completion of a major component of the Work.
3. Extra record photographs at time of final acceptance.
4. Owner's request for special publicity photographs.

3.2 CONSTRUCTION VIDEO RECORDINGS

A. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.

B. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.

C. Confirm date and time at beginning and end of recording.

D. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.

E. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer or Owner.

F. Flag construction limits before recording construction video recordings.

G. Show existing conditions adjacent to Project site before starting the Work.

H. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.

I. Show protection efforts by Contractor.

J. Periodic Construction Video Recordings: Record video recording as requested by Engineer or Owner. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 01 Section “Closeout Procedures” for submitting warranties and Project Record Documents.
2. Division 01 Section “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Engineer's responsive action.

B. Informational Submittals: Written information that does not require Engineer's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of base plans of the Contract Drawings for Contractor's use in preparing submittals will not be provided.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

C. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. If resubmittal is necessary, process it in same manner as initial submittal.
3. Allow 15 days for processing each resubmittal.
4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
5. Submittals out of sequence from agreed upon schedule may result in back charges to the Contractor.

E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space on label or beside title block to record Contractor's review and approval markings.
3. Include the following information on label for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name and address of Contractor.
    d. Name and address of subcontractor.
    e. Name and address of supplier.
    f. Name of manufacturer.
    g. Unique identifier, including revision number.
    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Other necessary identification.
    k. Furnish as Submitted
    l. Furnish as Corrected
    m. Furnish as Corrected & Confirm
    n. Make Corrections Noted
    o. Revise & Resubmit
    p. Rejected

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals. Provide a copy of the pertinent product specification, with each paragraph check-marked to indicate compliance. Any deviations are to be noted and explained.

G. Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Engineer in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

C. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

D. Mark each copy of each submittal to show which products and options are applicable.

1. Include the following information, as applicable:
   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Standard color charts.
   e. Manufacturer's catalog cuts.
   f. Wiring diagrams showing factory-installed wiring.
   g. Printed performance curves.
   h. Operational range diagrams.
   i. Mill reports.
   j. Standard product operating and maintenance manuals.
   k. Compliance with recognized trade association standards.
   l. Compliance with recognized testing agency standards.
   m. Application of testing agency labels and seals.
   n. Notation of coordination requirements.

E. Number of Copies: Submit three copies, plus the number of copies the Contractor desires to have returned.

F. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

G. Preparation: Include the following information, as applicable:

1. Dimensions.
2. Identification of products.
3. Fabrication and installation drawings.
4. Roughing-in and setting diagrams.
5. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
6. Shopwork manufacturing instructions.
7. Templates and patterns.
8. Schedules.
9. Design calculations.
10. Compliance with specified standards.
11. Notation of coordination requirements.
12. Notation of dimensions established by field measurement.
13. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

H. Number of Copies: Submit three copies plus the number of copies the Contractor desires to have returned of each submittal Engineer will retain three prints; remainder will be returned.

I. Samples: Prepare physical units of materials or products as applicable, including the following:

1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Attach label on unexposed side that includes the following:
4. Generic description of Sample.
5. Product name or name of manufacturer.
6. Sample source.

J. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

K. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

L. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

B. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Engineer will not return copies.

C. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

D. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and Engineers, and other information specified.

F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

H. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

I. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

J. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

K. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

O. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Review of submittals by Engineer is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

C. Review of submittals by Engineer is not for purpose of determining the accuracy and completeness of dimensions and quantities, or substantiating installation instructions.

D. Re-submittal Review: Submittals marked as "Revise & Resubmit" or "Resubmit" will be re-reviewed and stamped with an action stamp. Engineer will mark the stamp appropriately to indicate action taken. If the re-submittal is marked as "Revise & Resubmit" or "Resubmit", the Owner will deduct the amount of the Engineer's compensation for subsequent re-submittal review from the final payment to the Contractor as provided on the Bid Form.

E. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Furnish as Submitted: Where submittal is marked "Furnish as Submitted", the Work covered by the submittal may proceed provided it complies with the Contract Documents.
2. Furnish as Corrected: Where submittal is marked "Furnish as Corrected ", the Work covered by the submittal may proceed provided it complies with both Engineer's notations and corrections on the submittal and the Contract Documents.
3. Furnish as Corrected & Confirm: Where submittal is marked "Furnish as Corrected & Confirm", the Work covered by the submittal may proceed provided it complies with both Engineer's notations and corrections on the submittal and the Contract Documents, but Contractor must acknowledge Engineer’s comments in writing.
4. Make Corrections Noted: Where the submittal is marked "Make Corrections Noted", do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Engineer's notations and corrections.
5. Revise & Resubmit: Where the submittal is marked "Revise & Resubmit", do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
6. Rejected: Where the submittal is marked “Rejected”, Contractor shall prepare a new submittal for a different product that complies with the Contract Documents.

F. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

C. Specific quality-assurance and quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

D. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.

E. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

F. Related Sections include the following:
1. Divisions 02 through 44 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades-people of the corresponding generic name.

L. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum

quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.
10. Reports: Prepare and submit certified written reports that include the following:
11. Date of issue.
12. Project title and number.
13. Name, address, and telephone number of testing agency.
14. Dates and locations of samples and tests or inspections.
15. Names of individuals making tests and inspections.
16. Description of the Work and test and inspection method.
17. Identification of product and Specification Section.
18. Complete test or inspection data.
19. Test and inspection results and an interpretation of test results.
20. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
21. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
22. Name and signature of laboratory inspector.
23. Recommendations on retesting and reinspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice and maintains current licensure in the state of Georgia, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

G. Requirement for specialists shall not supersede building codes and regulations governing the Work.

H. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

I. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

J. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

K. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

L. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

M. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

B. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

C. Payment for these services will be made from testing and inspecting allowances, as authorized by Owner.

D. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

E. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

F. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

G. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

H. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

I. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

J. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

K. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

L. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

M. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

N. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

O. Notify Engineer, Construction Project Manager and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

P. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

Q. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

R. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

S. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

T. Do not perform any duties of Contractor.

U. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

V. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

W. Schedule times for tests, inspections, obtaining samples, and similar activities.

X. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

Y. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

B. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.

C. Notifying Construction Project Manager and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

D. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer, with copy to Contractor and to authorities having jurisdiction.

E. Submitting a final report of special tests and inspections at Substantial Completion, that includes a list of unresolved deficiencies.

F. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

G. Retesting and re-inspecting corrected work.

1.9 PAYMENT FOR TESTING

A. Initial Services: Contractor shall employ, pay for, and schedule the services of all independent testing laboratories required to perform the inspections and tests specified in these documents.

B. Retesting: Should retesting be required to confirm non-compliance or confirm that reworked non-compliance items are now in compliance; Contractor shall pay for the testing.

C. Retesting at Construction Project Manager's Request: Should the Engineer request additional testing over and above the retesting required to confirm compliance, cost for the testing shall be the responsibility of the Contractor, should the additional testing confirm the non-compliance of an item. If the testing requested by the Construction Project Manager fails to confirm non-compliance, cost for the testing shall be the responsibility of the Owner.

D. Disputed Testing Results: Should the compliance of an item remain in dispute after retesting is complete, the Contractor shall coordinate obtaining the services of a second laboratory to test the disputed item. Should the testing results or observations obtained from the second laboratory confirm the item in question is not in compliance, the Contractor shall pay all costs for the additional testing effort performed by second laboratory. Should the results/observations provided by the second laboratory confirm the item in question is in compliance, the Owner shall pay for the second laboratory's testing/observation effort.

E. Contractor's Convenience Testing:

1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 2 -PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

C. Protect construction exposed by or for quality-control service activities.

D. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

"Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

"Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

"Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

"Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

"Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

"Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

"Provide": Furnish and install, complete and ready for the intended use.

"Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

D. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AASHTO	American Association of State Highway and Transportation Officials **www.transportation .org**	(202) 624-5800
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AGA	American Gas Association www.aga.org	(202) 824-7000
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400

ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
EJCDC	Engineers Joint Contract Documents Committee www.asce.org	(800) 548-2723 (703) 295-6300
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
GRI	Geosynthetic Research Institute (See GSI)	
GSI	Geosynthetic Institute	(610) 522-8440

	www.geosynthetic-institute.org	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFPA	NFPA www.nfpa.org	(800) 344-3555 (617) 770-3000
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
SAE	SAE International	(724) 776-4841

	www.sae.org	
SPI/SPFD	Society of the Plastics Industry, Inc. (The) Spray Polyurethane Foam Division (See SPFA)	
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
UL	Underwriters Laboratories Inc. www.ul.com	(800) 285-4476 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. (See ICC)	
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials **www.iapmo.org**	(909) 472-4100
ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) **www.iccsafe.org**	(703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. **www.icc-es.org**	(800) 423-6587 (562) 699-0543
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are

subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers **www.usace.army.mil**	
EPA	Environmental Protection Agency **www.epa.gov**	(202) 272-0167
FAA	Federal Aviation Administration **www.faa.gov**	(202) 366-4000
NOAA	National Oceanic and Atmospheric Administration **www.noaa.gov**	(202) 482-3154
HUD	Department of Housing and Urban Development **www.hud.gov**	(202) 708-1112
OSHA	Occupational Safety & Health Administration **www.osha.gov**	(800) 321-6742 (202) 693-1999
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
USDA	United States Department of Agriculture **www.usda.gov**	(202) 720-2791
USPS	United States Postal Service **www.usps.com**	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

Georgia

DNR Department of Natural Resources

EPD Environmental Protection Division

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

1. Temporary utilities include, but are not limited to, the following:
   a. Sewers and drainage.
   b. Water service and distribution.
   c. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
   d. Heating and cooling facilities.
   e. Ventilation.
   f. Electric power service.
   g. Lighting.
   h. Telephone service.

2. Support facilities include, but are not limited to, the following:
   a. Temporary roads and paving.
   b. Dewatering facilities and drains.
   c. Project identification and temporary signs.
   d. Waste disposal facilities.
   e. Field offices.
   f. Storage and fabrication sheds.
   g. Lifts and hoists.
   h. Temporary stairs.
   i. Construction aids and miscellaneous services and facilities.

3. Security and protection facilities include, but are not limited to, the following:
   a. Environmental protection.
   b. Stormwater control.
   c. Tree and plant protection.
   d. Pest control.
   e. Site enclosure fence.
   f. Security enclosure and lockup.
   g. Barricades, warning signs, and lights.
   h. Covered walkways.
   i. Temporary enclosures.
   j. Temporary partitions.
   k. Fire protection.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

DEFINITIONS

A. Permanent Enclosure: As determined by Owner, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary closures.

USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Owner's forces.
   2. Occupants of Project.
   3. Owner.
   4. Testing agencies.
   5. Personnel of authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Use water from Owner's existing water system after notification and approval by Owner.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

B. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

C. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.
3. Contractor shall coordinate with Owner on use of existing building and premises for storage of construction materials and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Owner. Provide materials suitable for use intended.

B. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

C. Water: Potable.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Heating Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

2.3 PROJECT IDENTIFICATION AND SIGNS

A. Construct frame for identification and signs from new wood or galvanized steel.

B. Materials:
1. Corrugated plastic; for signs larger than 2 feet by 2 feet, mount on exterior grade plywood.
2. Aluminum; thickness of 0.04 gauge.
3. Medium Density Overlay Plywood.
4. Alumanite. ®
5. Dibond. ®
6. Lusterboard. ®

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Install project identification sign within thirty days after Notice to Proceed date.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

C. Project Identification and Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site. Contractor shall coordinate with Owner on use of existing building and premises for storage facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments, silt fences, check dams, and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding and siltation by runoff of stormwater from heavy rains. All stormwater controls shall meet the requirements of the Georgia Environmental Protection Division.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
3. Repair deterioration and damage to project identification and signs. Keep signs clean.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification and signs.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION PREVENTION AND SEDIMENT CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work shall include providing erosion prevention and sediment control measures for all excavation and other construction activities within the limits of the site, any temporary or permanent easements, and within any borrow or spoil areas used during the entire duration of construction. During dry weather, sprinkle sites with water or use other means necessary to control dust.

QUALITY ASSURANCE

A. All erosion prevention and sediment control work shall comply with applicable requirements of governing authorities having jurisdiction and of the National Pollutant Discharge Elimination System (NPDES). The specifications, drawings and are not represented as being comprehensive, but rather convey the intent to provide complete erosion prevention and sediment control for the Owner's and adjacent properties. In the event of a discrepancy between these documents and requirements of authorities having jurisdiction, the more stringent of the two shall take precedence.

B. Erosion prevention and sediment control measures shall be provided prior to commencement of construction and diligently maintained for the entire duration of construction. On-site and off-site areas which are especially vulnerable to damage from erosion and sedimentation are to be identified and receive special attention.

C. All land-disturbing activities shall be planned and conducted to minimize the area and time of exposure and to prevent discharge of sediment laden water from the site.

D. Surface water runoff originating upgrade of exposed areas shall be diverted to reduce erosion and sediment loss during the period of exposure.

E. The Contractor is responsible for removal of sediment from all erosion prevention and sediment control structures, barriers and ponds when capacity of the feature is reduced by one-half [by authorities having jurisdiction].

F. The Contractor is required to perform inspections and document conditions of erosion prevention and sediment control measures. Frequency of inspection shall be as set forth in the by authorities having jurisdiction. Maintenance shall be performed promptly.

G. The Contractor is responsible for obtaining all required land disturbance permits associated with construction activity at this site for the Project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed stone for stabilized construction entrance/exit shall be clean and 2 to 3.5 inches in diameter. Filter fabric for stabilized construction entrance/exit shall be Mirafi 135N or equivalent.

B. Silt fence shall be "Envirofence" preassembled silt fence by Mirafi, Inc., or equivalent. Tensile Strength (Lbs. Minimum) warp 120, fill 100 per ASTM D-4632; Elongation (% Maximum) 40, per ASTM D-4632; Apparent Opening Size #30 per ASTM D-4751; Flow Rate (Gal/Min/Sq. Ft.) 25, Ultraviolet Stability of 80 per ASTM D-4632 after 300 hours of weathering per ASTM D-4355); Bursting Strength (PSI, Minimum) 175 per ASTM D-3786.

C. Gravel Filled Bags: Bags shall be of like material to silt fence. Gravel shall be clean #57 or #67 crushed stone. Filled bags shall be at least 2 feet long, 1'-6" wide and 6 inches thick.

D. Rock for check dam structures shall be clean, small rip rap (2 to 15 inches in diameter).

E. Strawbales: Bales shall be either wire bound or string tied and placed with bindings orientated around sides rather than top and bottom.

F. Temporary Vegetation: Seed mixtures including rye, annual ryegrass, wheat, oats, barley, Sudan grass, wheat, oats, Fescue, Lespedeza, millet, and/or Bermudagrass that provide quick protection shall be used to temporarily stabilize disturbed areas that will not be brought to final grade for 30 days or more.

G. Temporary mulches shall consist of straw or hay, composted materials, wood chips or cellulose fiber, asphalt, and/or rolled erosion control products.

H. Erosion Control Blanket/Matting: Blanket and matting materials shall be non-toxic to vegetation. Netting shall be photodegradable and intertwined with mulch/fiber material. Mulch and fiber material shall consist of straw, excelsior (curled wood), coconut, or jute (woven root fiber).

PART 3 - EXECUTION

3.1 PROTECTION

A. Conduct construction so as to provide the site with maximum protection from erosion at all times.

B. Conduct excavation activities to provide erosion and sediment control as follows:

1. Clearing and excavation shall not commence until such work is approved and permitted by local authorities having jurisdiction. Coordinate with authorities having jurisdiction for permitting requirements.
2. Stockpile excavated material so as not to block any drainage area. Replace this excavated material in the trench immediately after repairs or installations have been completed and are approved by the Engineer or local authority.
3. Retain natural vegetation whenever feasible.
4. Stabilize exposed areas as quickly as possible by means of seeding and mulching. Use diversion ditches, or other methods, to prevent storm water from running over the exposed area until seeding is established as specified.
5. Take particular care along streams and drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the streamflow. Exercise care to minimize disturbance of streambanks. Wherever the streambanks are affected by construction, reduce the slope of the streambanks to provide a suitable condition for establishment of vegetative protection.
6. Retard the velocity of runoff water by use of barriers, traps and basins.

7. Trap the sediment contained in runoff water.
8. Take care during the hauling of materials, etc., to keep vehicles from creating a severe erosion problem.
9. Control dust by application of water or other means, as necessary.
10. Stabilize roadways and driveways as soon as feasible.

C. Regrade and stabilize surfaces eroded or otherwise damaged during any and all construction operations.

3.2 STABILIZED CONSTRUCTION ENTRANCE / EXIT

A. Length: As effective, but not less than 150 feet.

B. Thickness: Not less than eight (8) inches. A layer of medium grade filter fabric shall be placed on the subgrade before placement of stone.

C. Width: The full width of all points of ingress and egress, but not less than 20 feet.

D. Radii: Radii shall be appropriate for type of traffic, but not less than 20 feet.

E. Washing: When necessary, vehicles shall be cleaned of sediment prior to exiting the site onto public right-of-way. When washing is required, it shall be done in an area stabilized with crushed stone and draining into an approved sediment trap or basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through use of approved methods.

F. Maintenance: The entrance shall be maintained in a condition, which prevents transport of sediment off of the site or onto public rights-of-way. This may require periodic top dressing with additional stone and maintenance of measures used to trap sediment. All sediment transported onto public rights-of-way shall be removed immediately.

3.3 SILT FENCING

A. Silt fencing shall be placed on proposed line, parallel to contours, and within an excavated trench of minimum 6 inch depth and width. Excavated soil shall be backfilled against the uphill side of the barrier. The bottom edge of silt fence must be entrenched and backfilled to be effective.

B. Silt fencing shall be purchased in continuous rolls and cut to length of the barrier. When joints are unavoidable, filter material shall be spliced together only at support posts and overlapped a minimum of 6 inches.

C. Install the silt fence in accordance with the manufacturer's recommendations and the details shown on the plans.

3.4 STRAW BALE BARRIERS

A. Bales shall be installed in a trench excavated to the width of the bale, the length of the proposed barrier, and to a minimum depth of 4 inches. Excavated soil shall be backfilled against the uphill side of the barrier.

B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another, such that no gaps are evident. In swales and ditches the barrier shall extend up each side slope such that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale.

C. Bales shall be anchored with at least two stakes or rebars through each bale and a minimum of 8 inches into the ground. Provide safety caps if rebar is used to anchor straw bales.

3.5 TEMPORARY VEGETATIVE COVER

A. Soil shall be tested to determined nutrient levels. If soil does not contain sufficient nutrient levels, work 12-12-12 analysis fertilizer 2 to 4 inches deep into soil at a rate of 400-600 pounds per acre.

B. Seed shall be certified by the local State Department of Transportation or Soil Conservation office.

C. To promote temporary vegetation establishment; provide lime, fertilizer (as determined by soil testing) and above-ground irrigation as necessary.

D. Provide mulch consisting of straw or hay, composted materials, wood chips or cellulose fiber, asphalt, or erosion control blanket to cover a minimum of 75% of the area receiving temporary vegetative cover.

E. Temporary vegetation shall be made non-viable, with herbicide or other means, prior to seeding and planting of permanent species.

3.6 EROSION CONTROL BLANKET/MATTING

A. Seed and fertilizer (if required) shall be applied before installation of a blanket or mat.

B. Follow manufacturer's directions for orienting, overlapping, entrenching and securing blankets and mats. Generally orient blanket and mat rolls vertically along a slope, from top to bottom. Horizontal orientation is allowable only for slopes with steepness less than 2:1 and a height of less than twice the roll width.

C. Always entrench the blanket or mat a minimum of 6 inches at any joint, any structure, and at the top and bottom of a slope.

3.7 ROCK CHECK DAMS

A. Provide rock check dams in locations shown on the plans. Maximum spacing shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

B. The center of each check dam should be at least 9 inches lower than its outer edges. Height of the dam shall not exceed 2 feet at its centerline.

3.8 INLET PROTECTION

A. Excavation around the drop inlet (non-paved areas) shall be performed to accommodate the barrier type implemented (e.g. silt fence, straw bales, gravel filled bags). Backfilled material shall be placed on the upstream side of the barrier.

3.9 DUST CONTROL

A. Dust generated during performance of the work shall be controlled by applying water and/or polyacrylamide (PAM). Provide PAM when timely establishment of vegetative cover is not possible.

B. Water and/or shall be provided in the amounts and locations in accordance with general local practice. Do not apply PAM within 25 feet of a natural stream or storm water conveyance.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
1. Division 01 Section "References" for applicable industry standards for products specified.
2. Division 01 Section "Closeout Procedures" for submitting warranties for contract closeout.
3. Divisions 02 through 44 Sections for specific requirements for warranties on products and installations.

DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Completed List: Within 30 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   3. Engineer's Action: Engineer will respond in writing to Contractor within 15 days of receipt of completed product list. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer's response, or lack of response, does not constitute a waiver of requirement that products comply with the Specifications.

B. Substitution Requests: This form is to be used by the awarded vendor. Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided at end of Section. Other forms are not acceptable.
   2. Substitutions will not be considered when indicated on shop drawings or product data submittals.
   3. Substitutions will not be considered unless submitted through the General Contractor.
   4. Additional studies, investigations, submittals, redesign and/or analysis by the Engineer caused by requested substitution shall be paid by the Contractor at no expense to the Owner.
   5. Only one request for substitution for each product will be considered. When substitution is not acceptable to Engineer, provide specified product.
   6. Engineer will determine the acceptability of all substitutions.

C. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   1. Statement indicating reason for substitution.
   2. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
   3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   5. Samples, where applicable or requested.
   6. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   7. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   8. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be

provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

9. Cost information, indicating the difference in cost between specified product(s) and proposed substitution.
10. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
11. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
12. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation upon receipt of a request for substitution.
13. Use product specified if Engineer is unable to make a decision on use of a proposed substitution within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.
10. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
11. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding spaces.
12. Handle products by using methods that will prevent bending or over stressing.
13. Lift heavy components only at designated lifting points.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Engineer reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Owner will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Owner’s.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
6. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a

comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

2.2 PRODUCT SUBSTITUTIONS

A. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements.

1. Requested substitution does not require extensive revisions to the Contract Documents.
2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
3. Substitution request is fully documented and properly submitted.
4. Requested substitution will not adversely affect Contractor's Construction Schedule.
5. Requested substitution has received necessary approvals of authorities having jurisdiction.
6. Requested substitution is compatible with other portions of the Work.
7. Requested substitution has been coordinated with other portions of the Work.
8. Requested substitution provides specified warranty.
9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SUBSTITUTION REQUEST FORM

GENERAL: Form shall be submitted via General Contractor to Owner.

PROJECT TITLE AND NO._____

TO: _____

Telephone: _____

ATTN:_____

DATE OF REQUEST: _____

SPECIFIED ITEM_____

Section_____Paragraph _____

REASON FOR SUBSTITUTION:_____

PROPOSED SUBSTITUTE: (indicate manufacturer and model) _____

Attach complete description, catalog, spec data, and laboratory tests.

1. Describe change to Contract Documents proposed substitute will require for its proper installation.

2. Will substitution affect electrical requirements, wiring, piping, equipment, systems, ductwork, etc. indicated in Contract Documents?

___ No ___ Yes; Explain: _____

3. Proposed substitution affects other trades. ___ No ___ Yes; Explain: _____

4. List all differences between proposed substitute and specified product/material: (noise, weight, power, size, gage, finishes, dimensions, etc.) _____

5. List (on separate sheet) the availability of maintenance services and replacement materials for proposed substitution.

6. List (on separate sheet) company names, addresses, phone numbers and contact persons of fabricators and suppliers for proposed substitution.

7. Will substitution affect the construction schedule?
___ No ___ Yes; Explain _____

8. If the substitution request is accepted, it will result in: No cost impact _____

Lower cost (How much) _____ Added cost (How much) _____

9. Are there any additional license fees and/or royalties pending on the proposed substitute.
_____ No _____ Yes; Explain: _____

10. The undersigned certifies/agrees:
Same warranty/guarantee will be furnished for proposed substitute as for specified product.
Same maintenance service and source of replacement parts, as applicable, is available.
Payment will be made for changes to building design, including Owner design, detailing and construction costs caused by the substitution.

SUBMITTED BY: (Supplier or Subcontractor)

Firm: _____

Address: _____

Name and Title of Person Signing: _____

Signature: _____

Telephone No.: _____ Date: _____

REVIEWED AND APPROVED for Subcontractor or Supplier by (General Contractor):

Firm: _____

Address: _____

Name and Title of Person Signing: _____

Signature: _____

Telephone No.: _____Date: _____

ENGINEER'S REVIEW AND ACTION:

_____ Accepted - Make submittals in accordance with Specification Section 01 3300.

_____ Accepted as Noted - Make submittals in accordance with Specification Section 01 3300.

_____ Rejected - Use specified materials.

_____ Received too late - Use specified materials.

Signature: _____ Date: _____

Remarks: _____

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:
1. Division 01 Section "Summary" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures"
3. Division 01 Section "Closeout Procedures"

DEFINITIONS

Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor and professional engineer, as applicable.

B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements, as applicable.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.

4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
6. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Certified Surveys: Submit two copies signed by land surveyor, as applicable

E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data, as applicable.

QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer or Owner’s opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility or Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices, as applicable.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.

I. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

J. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

K. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

L. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
4. Use containers intended for holding waste materials of type to be stored.
5. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   a. Remove liquid spills promptly.
   b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Division 01 Section "Execution" for progress cleaning of Project site.
3. Division 01 Section "Project Record Documents" for submitting record Drawings and record Product Data.
4. Divisions 02 through 44 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 working/14 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 44 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 44 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 working/14 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 working/14 calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 working/14 calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element.
3. Include the following information at the top of each page:
   Project name.
   Date.
   Name of Engineer.
   Name of Contractor.
   Page number.
4. Submit list of incomplete items in the following format:
   PDF electronic file.

SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 working/21 calendar days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide digital copies of each warranty to Engineer to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

C. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. Remove snow and ice to provide safe access to building.
6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
8. Sweep concrete floors broom clean in unoccupied spaces.
9. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

11. Remove labels that are not permanent.
12. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
13. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
14. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
15. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
16. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
17. Leave Project clean and ready for occupancy.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
3. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
4. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
5. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

DEFINITIONS

System: An organized collection of parts, equipment, or subsystems united by regular interaction.

Subsystem: A portion of a system with characteristics similar to a system.

CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
2. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
3. Enable inserted reviewer comments on draft submittals.
4. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer, through Construction Manager, will return two copies.

A. Initial Manual Submittal: Submit draft copy of each manual at least 10 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing item`s and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.

10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
2. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
3. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents [and indicate Specification Section number on bottom of spine]. Indicate volume number for multiple-volume sets.
4. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
5. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
6. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
7. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate

locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.

5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.
7. List of cleaning agents and methods of cleaning detrimental to equipment.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

I. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.3 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
1. Record Drawings.
2. Operation and Maintenance Manuals.
3. Miscellaneous record submittals.

B. Related Requirements:
1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Divisions 02 through 44 Sections for specific requirements for project record documents of the Work in those Sections.

CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

B. Initial Submittal:
1. Submit one paper-copy set(s) of marked-up record prints.
2. Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

C. Final Submittal:
1. Submit three paper-copy set(s) of marked-up record prints.
2. Print each drawing, whether or not changes and additional information were recorded.

D. Operation and Maintenance Manuals:
1. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing initial testing. Engineer will comment on whether general scope and content of manual are acceptable.
2. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing initial testing. Engineer will return copy with comments.
a. Correct or revise each manual to comply with Engineer’s comments. Submit copies of each corrected manual within 15 days of receipt of Engineers comments and prior to commencing initial testing.

E. Furnish, prior to substantial completion, five copies of final maintenance manuals. All corrections shall have been made necessary to comply with Engineer’s comments in the final manuals. Final manuals shall be indexed and composed of suppliers' maintenance manuals on

all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished.

F. Contractor is responsible for providing any additional operation and maintenance data specific to certain equipment as specified in Divisions 02 through 44 Sections of these specifications.

G. Miscellaneous Record Submittals: See other Specification Sections for additional miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

B. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

1. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
2. Accurately record information in an acceptable drawing technique.
3. Record data as soon as possible after obtaining it.
4. Record and check the markup before enclosing concealed installations.
5. Cross-reference record prints to corresponding archive photographic documentation.

C. Content: Types of items requiring marking include, but are not limited to, the following:

1. Dimensional changes to Drawings.
2. Revisions to details shown on Drawings.
3. Depths of foundations below first floor.
4. Locations and depths of underground utilities.
5. Revisions to routing of piping and conduits.
6. Revisions to electrical circuitry.
7. Actual equipment locations.
8. Duct size and routing.
9. Locations of concealed internal utilities.
10. Changes made by Change Order.
11. Changes made following Engineer's written orders.
12. Details not on the original Contract Drawings.
13. Field records for variable and concealed conditions.
14. Record information on the Work that is shown only schematically.

D. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

E. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

F. Mark important additional information that was either shown schematically or omitted from original Drawings.

G. Note alternate numbers, Change Order numbers, and similar identification, where applicable.

H. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

I. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

J. Identification: As follows:
1. Project name.
2. Date.
3. Designation "PROJECT RECORD DRAWINGS."
4. Name of Engineer.
5. Name of Contractor.

2.2 OPERATION AND MAINTENANCE MANUALS

A. Maintenance manuals are to be of a hardback, loose-leaf type and of a durable quality. In addition, a complete electronic copy shall be provided in MS-Word or searchable Adobe PDF format.

B. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted. Where non-relevant information is present in the manual, it shall be neatly marked out with a single “X” through non-relevant portions.

C. Include in each set of manuals the following:
1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
2. Control and wiring diagrams.
3. Installation, operation (including start up and shut down procedures), lubrication and maintenance instructions.
4. Manufacturers recommended spare parts list.

D. If an Owner's representative is assigned to the project either through the Owner or the Engineer, the Contractor shall make a copy of all instruction manuals available to the Representative. Manuals on specific items shall be available prior to installation of the item. This requirement in no way relieves the Contractor of his other responsibilities.

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as paper copy.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer and Owner reference during normal working hours.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:
1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

B. Identification: On each copy, provide an applied label with the following information:
1. Name of Project.
2. Name and address of videographer.
3. Name of Construction Manager.
4. Name of Contractor.
5. Date of video recording.

C. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

C. Basis of System Design, Operational Requirements, and Criteria: Include the following:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Regulatory requirements.
5. Equipment function.
6. Operating characteristics.
7. Limiting conditions.
8. Performance curves.

D. Documentation: Review the following items in detail:
1. Emergency manuals.

2. Operations manuals.
3. Maintenance manuals.
4. Project record documents.
5. Identification systems.
6. Warranties and bonds.
7. Maintenance service agreements and similar continuing commitments.

E. Emergencies: Include the following, as applicable:
1. Instructions on meaning of warnings, trouble indications, and error messages.
2. Instructions on stopping.
3. Shutdown instructions for each type of emergency.
4. Operating instructions for conditions outside of normal operating limits.
5. Sequences for electric or electronic systems.
6. Special operating instructions and procedures.

F. Operations: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Control sequences.
6. Safety procedures.
7. Instructions on stopping.
8. Normal shutdown instructions.
9. Operating procedures for emergencies.
10. Operating procedures for system, subsystem, or equipment failure.
11. Seasonal and weekend operating instructions.
12. Required sequences for electric or electronic systems.
13. Special operating instructions and procedures.

G. Adjustments: Include the following:
1. Alignments.
2. Checking adjustments.
3. Noise and vibration adjustments.
4. Economy and efficiency adjustments.

H. Troubleshooting: Include the following:
1. Diagnostic instructions.
2. Test and inspection procedures.

I. Maintenance: Include the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Procedures for routine cleaning
5. Procedures for preventive maintenance.
6. Procedures for routine maintenance.
7. Instruction on use of special tools.

J. Repairs: Include the following:
1. Diagnosis instructions.
2. Repair instructions.
3. Disassembly; component removal, repair, and replacement; and reassembly instructions.
4. Instructions for identifying parts and components.

5. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

D. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

E. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

C. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.

D. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.

E. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.

F. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

1. Name of Contractor/Installer.
2. Business address.
3. Business phone number.
4. Point of contact.
5. E-mail address.

G. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.
2. Produce segments to present a single significant piece of equipment per segment.
3. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
4. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

H. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

I. Furnish additional portable lighting as required.

J. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

K. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

L. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Section 312000 "Earth Moving" for excavation and backfill under slabs-on-grade.

1.2 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material certificates.

C. Material test reports.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to Fulton County, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or Type II

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513 for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

C. Flexible PVC Waterstops: CE CRD-C 572 for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

E. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: **[ASTM D 1751, asphalt-saturated cellulosic fiber] [or] [ASTM D 1752, cork or self-expanding cork].**

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range water-reducing admixture or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture] <Insert dimension>, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (38-mm) nominal maximum aggregate size. Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished floors.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

SECTION 034100
PRECAST STRUCTURAL CONCRETE

PART 1 -GENERAL

1.1 SUMMARY

A. Section Includes precast structural concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture.

C. Shop Drawings:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator

B. Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

C. Welding certificates.

D. Material certificates.

E. Material Test Reports: For aggregates.

F. Source quality-control reports.

G. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:

a. Group C.

2. Fabricator is located within 500 miles of Project site.

B. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.5 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design precast structural concrete units.

B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

C. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

1. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M or ASTM A 1064/A 1064M, flat sheet.

F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.3 PRESTRESSING TENDONS

A. Strand: ASTM A 416/A 416M, Grade 270, uncoated, seven-wire, low-relaxation strand.

1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C 618, Class N.
3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
5. Blended Hydraulic Cement: ASTM C 595/C 595M.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.5 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

D. Malleable-Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30.

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 or ASTM A 490 Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.

1. Do not zinc coat ASTM A 490 bolts.

L. Zinc-Coated Finish: For exterior steel items**,** steel in exterior walls**,** and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M.

1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in SSPC-Paint 25 according to SSPC-PA 1.

2.6 BEARING PADS

A. Provide bearing pads for precast structural concrete units as recommended by precast fabricator for application.

2.7 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
2. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: Limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.9 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

K. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

L. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.10 CASTING INSULATED WALL PANELS

A. Cast, screed, and consolidate wythe supported by mold.

B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Cast, screed, and consolidate top wythe to meet required finish.

2.11 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.12 COMMERCIAL FINISHES

A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch (3 mm) and fill holes larger than 1/2 inch (13 mm). Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).

B. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch (13 mm) caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch (6 mm) in width that occur more than once per 2 sq. in. (1300 sq. mm). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch (3 mm).

C. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur more than once per 2 sq. in.. Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.

D. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch in width or smaller, and form marks where the surface deviation is less than 1/16 inch. Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.

E. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

F. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

G. Apply roughened surface finish according to ACI 318 to precast concrete units that receive concrete topping after installation.

2.13 SOURCE QUALITY CONTROL

A. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.

B. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
2. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
3. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

D. Field cutting of precast units is not permitted without approval of Engineer.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

3.2 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections at the fabricator's facility.

B. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

C. Testing agency will report test results promptly and in writing to Contractor and Construction Manager.

D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.4 REPAIRS

A. Repair precast structural concrete units if permitted by Construction Manager.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by the Construction Manager.

3.5 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

SECTION 050810
FLAT ALUMINUM COVERS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish and install flat aluminum covers and accessories, complete and in place, all in accordance with the requirements of the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 233120 – FRP Duct and Dampers

1.03 REFERENCED SPECIFICATIONS, CODES, AND STANDARDS

1. ASTM C509 Standard Specifications for Elastomeric Cellular Preformed Gasket and Sealing Material

2. ASTM C1115-00 Standard Specification for Dense Elastomeric Silicone Rubber Gaskets

3. ASTM C920 Standard Specification for Elastomeric Joint Sealants

4. Aluminum Association Specifications for Aluminum Structures

5. Aluminum Association Aluminum Design Manual; Specifications and Guidelines for Aluminum Structures

6. ASCE 8-02 Specification for the Design of Cold-Formed Stainless Steel Structural Members

7. ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

8. AASHTO Division 2 Section 25 Elastomeric Bearings

9. Federal Specification TT-S-00230C

10. Federal Specification A-A-59588

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

B. The manufacturer must have designed, manufactured and installed at least one (1) formed panel flat cover of the same type and size as unit(s) specified herein.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit Shop Drawings in accordance with the requirements of Division 01.

B. Before executing any of the work in this section, prints or drawings shall be submitted to the engineer showing dimensions, sizes, thickness, gauges, materials, finishes, joint attachment and erection procedure.

C. A complete set of design calculations for the cover(s) shall also be submitted. These calculations shall be signed by a registered professional engineer. All work shall be fabricated and erected in accordance with the approved drawings.

D. Certification that the specified material alloys, sizes and quantities have been furnished shall be submitted upon completion of the project.

E. The CONTRACTOR shall submit a copy of this specification with check-marks by each line to show full compliance or a note with attached supporting information noting any deviation for Engineer review.

1.06 WARRANTY

A. The formed panel flat cover manufacturer shall warrant that the work described herein shall be free from defects in workmanship and material. The flat cover manufacturer shall replace or repair faulty workmanship or defective material within a one (1) year period as described in Division 1.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Formed panel flat covers shall be clear span and self-supporting from the peripheral structure. The cover shall consist of removable panels each weighing no more than 100 pounds. The required lifting force per panel shall not exceed the dead weight of the panel. The formed panels shall utilize vertical bends that act as stiffeners to achieve structural rigidity. The bottom of the vertical stiffener shall be bent to form a joint that allows panels to interlock in order to form a complete cover system. The ends of the panels shall be sealed with flashing that attaches to the basin wall.

B. All metal components of the flat cover shall be aluminum or 300 series stainless steel. No galvanized, aluminized, painted, or plated steel shall be used anywhere in the cover. Dissimilar materials in the supporting structure shall be isolated from the aluminum cover by means of a compatible elastomeric gasket.

C. The formed panel cover shall have a mill finish surface.

D. Fasteners shall be designed with a factor of safety of 2.34 on ultimate strength and 1.65 on yield strength.

E. The removable formed panel flat cover system shall be designed to be substantially air and water tight under the specified design loading conditions

2.02 MATERIALS

A. The following is a summary of approved materials and/or material specifications. All aluminum alloys shall be as defined by the Aluminum Association and published in the ALUMINUM STANDARDS AND DATA.

1. Bolts and Fasteners - Bolts shall be 300 series stainless steel per ASTM F593, Alloy Group 1. Lock bolts shall be 7075-T73 aluminum or 305 stainless steel. Screws shall be aluminum or 300 series stainless steel.

2. Plates and Sheets - Plate and sheet material shall be aluminum alloy 3003-H16, 3105-H154, 6061-T6, 5052-H32 or 5052-H36; mill finish AA - M10 as fabricated. Formed panels for the flat cover shall have a minimum thickness of 0.090 inches.

3. Structural Shapes - Aluminum structural shapes shall be alloy 6061-T6.

4. Miscellaneous Shapes - Miscellaneous aluminum shapes shall be alloy 6061-T6, 6063-T5 or 6063-T6.

5. Gaskets - All gaskets shall be ozone resistant Silicone or Neoprene only. If Neoprene gaskets are utilized they must be shielded from exposure to ultraviolet light. The gaskets must have a ¼" minimum thickness.

6. Sealant - All sealants shall be silicone and resistant to ozone and ultraviolet light and conform to Federal Specification TT-S-00230C.

7. Miscellaneous Penetration Seals- All other penetration seals shall be weatherproof rubber seals.

8. Where duct or inlet air openings penetrate the cover, cover manufacturer shall furnish flanged connectors that are sized to mate with duct and/or dampers provided.

9. Support Bearings – Bearings at the supports (if required) shall conform to AASHTO Division 2 Section 25. Acceptable bearing surfaces for sliding bearings are Teflon to stainless steel only. In order to avoid damage to the Teflon and to reduce the coefficient of bearing friction, Teflon shall not bear on aluminum surfaces.

10. Where access hatches are required as shown on the Drawings, provide a flotation device on the hatch to enable rising and falling flood water to pass the cover without impedance. The floatation device shall be constructed of durable, puncture-resistant elastomer material and Type 316 stainless steel fasteners.

11. Provide non-slip adhesive treads for the top of flat covers to permit secure footing during wet conditions.

2.03 DESIGN LOADS

A. The entire formed panel flat cover structure shall be designed to sustain the loads specified herein, within the stress limitations of the Aluminum Association Aluminum Design Manual. In no case shall the formed panel flat cover be designed for any loads less than those specified by the local building code and/or local amendments.

B. The load cases to be considered shall be those described below unless more severe loads are specified by the purchaser.

1. Dead Load – The dead load shall be defined as the weight of the structure and all permanently attached to and supported by the structure.

2. Live Load – As required per ASCE 7-05 Section 4.9.1.

3. Snow Load – As required per ASCE 7-05 but not less than required by local building codes and/or local amendments.
   Importance Factor (I) = 1.0 or greater per ASCE 7-05 Table 1-1.
   Exposure Factor (C_e) = 1.0 or greater per ASCE 7-05 Table 7-2.
   Thermal Factor (C_t) = 1.2.

4. Non-Uniform Snow Load – As required per ASCE 7-05 but not less than required by local building codes and/or local amendments.

5. Wind Load – As required per ASCE 7-05 but not less than required by local building codes and/or local amendments...
   Importance Factor (I) = 1.0 or greater per ASCE 7-05 Table 6-1.
   Exposure Factor = C minimum or D where required.

6. Vacuum/Pressure Load:
   Vacuum – 16 inches water column
   Pressure – 8 inches water column

7. Load Combinations – As required per ASCE 7-05 Section 2.4.1.

8. Temperature - The load combinations listed above shall be considered for a temperature change of 100 degrees F below the installation temperature and 100 degrees F above the installation temperature and for a material temperature range of 40 degrees F below 0 to 160 degrees F above zero.

9. Panel Design Load - In addition to the above mentioned loads and load combinations, the aluminum panels shall be designed for a 250 pound load distributed over one square foot at any location. This load is to be taken as acting separately and not simultaneously with other design loads.

10. Deflection - For the above loads and load combinations, the deflection on the structural members shall not exceed L/180, and the cladding shall not exceed L/60 as defined by the Aluminum Association. Calculations stamped by a registered Professional Engineer shall be provided at the time of submittal to ensure that this requirement has been met.

2.04 MANUFACTURERS

A. Aluminum formed panel flat cover systems shall be as manufactured by CST Covers or Hallsten.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: All cover systems shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the site to avoid interferences with structural members, architectural features, openings and equipment. All installations shall be acceptable to the ENGINEER.

B. All work shall be executed by skilled mechanics with a supervisor experienced in the erection of formed panel flat covers.

3.02 INSPECTION

A. Inspection: All finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interference, and damage to pipe, fittings, and coating. Damage shall be repaired to the satisfaction of the ENGINEER.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 572/A 572M, Grade 50.

B. Channels and Angles: ASTM A 572/A 572M, Grade 50.

C. Plate and Bar: ASTM A 572/A 572M, Grade 50.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable.

C. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable, straight.

D. Threaded Rods: ASTM A 36/A 36M or ASTM A 193/A 193M, Grade B7.

2.4 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Primer and Top Coat: Comply Section 099123 "Interior Painting.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections as approved by Fulton County.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

END OF SECTION 051200

SECTION 05 51 19

METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes industrial-type, straight-run stairs with steel-grating treads and railings attached to metal grating stairs.

1.2 ACTION SUBMITTALS

A. Product Data: For metal grating stairs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments.

C. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

E. Wire Rod for Grating Crossbars: ASTM A 510.

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

G. Cast-Abrasive Nosings: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.

2.3 FASTENERS

A. Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.

5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.

C. Fabricate joints that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.

   a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded or pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.
2. Surface: Plain
3. Finish: Shop primed and painted.
4. Fabricate grating treads with rolled-steel floor plate or cast-abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

2.7 STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
2. Connect posts to stair framing by direct welding unless otherwise indicated.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

B. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055119

SECTION 099000
PAINTING AND COATING

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Surfaces to be finished are indicated in this section and on the Drawings.

1.2 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Shop-primed items.

B. Section 055119 - Metal Grating Stairs: Shop-primed items.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2004.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

4. Manufacturer's installation instructions.

5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

1.5 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Provide wall panel, 8 feet long by 8 feet wide, illustrating coating color, texture, and finish.

C. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.8 EXTRA MATERIALS

A. See Section 016000 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by The Engineer is obtained using the specified procedures for substitutions.

1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

D. Paints: Acceptable manufacturers are limited to the following:

1. Duron, Inc: www.duron.com.

2. ICI Paints: www.icipaintsinna.com.

3. Benjamin Moore & Co: www.benjaminmoore.com.

4. PPG Architectural Finishes, Inc: www.ppgaf.com.

E. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.

1. Provide ready mixed paints and coatings, except field-catalyzed coatings.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

C. Where sheen is not specified or more than one sheen is specified, sheen will be selected later by The Engineer from the manufacturer's full line.

D. Provide colors as directed by The Engineer.

1. Extend colors to surface edges; colors may change at any edge as directed by the Engineer.

2.4 INTERIOR PAINT SYSTEMS

A. Concrete Vertical and Overhead Surfaces:

1. Applications include but are not limited to walls.

2. Latex: Latex Primer Sealer MPI #3, Latex MPI #43, 44, 52, 53, 54 or 114.

3. Epoxy: Epoxy MPI #77, gloss.

B. Concrete Horizontal Surfaces:

1. Epoxy: Epoxy MPI #77, gloss.

C. Concrete Masonry Units:

1. Latex: Latex Block Filler MPI #4, Latex MPI #43, 44, 52, 53, 54 or 114.

   a. Gloss level 3.

2. Epoxy: Epoxy Block Filler MPI #4, Epoxy MPI #77, gloss.

D. Structural Steel and Metal Fabrications:

1. W.B. Light Industrial Coating: Rust Inhibitive Primer MPI #107, W.B. Light Industrial Coating MPI #151, #153, or #154.

2. Polyurethane Pigmented (over epoxy primer): Epoxy Primer MPI #76 or #79, Polyurethane MPI #72.

3. Polyurethane Pigmented (over inorganic zinc and epoxy): Inorganic Zinc Primer MPI #19, High Build Epoxy MPI #108, Polyurethane MPI #72.

4. Epoxy Modified Latex: Rust Inhibitive Primer MPI #107, Epoxy Modified Latex MPI #115, 215.

E. Galvanized Metal, Not Chromate Passivated:

1. Applications include but are not limited to doors, frames, railings, and piping.

2. Latex: Cementitious Primer MPI #26, Latex MPI #43, 44, 52, 53, 54 or 114.

   a. Gloss level 3.

3. W.B. Light Industrial Coating: Cementitious Primer MPI #26, W.B. Light Industrial Coating MPI #151, #153, or #154.

   a. Gloss level 3.

4. Epoxy (over epoxy primer): Epoxy Primer MPI #101, Epoxy MPI #77, gloss.

PART 3 - EXECUTION

3.1 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:

1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.

2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.

3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.

4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.

5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.

6. Paint interior surfaces of air ducts and convector with flat, nonspecular black paint where visible through registers, grilles, or louvers.

7. Paint dampers exposed behind louvers, grilles, and convector to match face panels.

C. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.

2. Items indicated to receive other finish.

3. Items indicated to remain naturally finished.

4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

3.2 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for The Engineer's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

2. Concrete Floors: 8 percent.

E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.

1. Report results in writing to The Engineer before starting work.

2. If results of test indicate need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from The Engineer.

3.3 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar

items already installed that are not to be painted.

1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.

2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.4 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.

1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.

1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.

2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as

recommended by manufacturer for material and texture required.

3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.

1. Number of coats and film thickness required are the same regardless of application method.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.

1. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

2. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.

3. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.

4. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.

5. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.

6. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.

7. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.5 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage

by cleaning, repairing or replacing, and repainting as approved by The Engineer.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION

SECTION 09941
FIELD PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and apply paints and coatings specified and indicated. Prepare, clean, and finish all surfaces to be field painted as specified and indicated.

1. The terms “paint” and “coating” used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate, or finish coats.

2. Stainless steel and plastic piping systems, fittings and supports will not be field painted, except that identification of piping with stencil text and flow arrows shall be required by the work of this section.

B. Contractor’s attention is directed to factory applied, shop painting shop painting specified under Section 099400, which is referenced and required in other specification sections. All items and surfaces specified above with shop painting shall be required to be compatible with field painting specified in the Paint Schedule herein.

C. Surfaces of new equipment items specified in Divisions 23, 33 and 44 which have a factory applied shop painting shall also be field painted as specified in the Paint Schedule herein. Do not field paint these items until installation and approved testing has been completed.

D. Surface preparation and prime coats will not be required on items delivered with a factory applied, shop painting and still in a condition approved by the Engineer.

E. Complete painting and test patches in accordance with specifications, paint manufacturer’s current surface preparation and application instructions and safety requirements. In the event of conflict, the more stringent specifications will apply.

F. Furnish and apply pipe, valve, and equipment identification legends as specified.

G. Contractor shall ensure that all tags and labels are not painted over. Contractor shall replace any illegible or painted over tags at no additional cost to the Owner

1.2 RELATED WORK

A. Section 333120: Ductile-Iron Pipe and Fittings.

B. Section 099400: Shop Painting.

1.3 REFERENCES

A. The Society for Protective Coatings (SSPC) Specifications:

1. SSPC-PA 1 (2004): Shop, Field, and Maintenance Painting.

2. SSPC-PA-2 (2004): Measurement of Dry Paint Thickness with Magnetic Gauges.

3. SSPC-SP 1 (2004): Solvent Cleaning.

4. SSPC-SP 3 (2004): Power Tool Cleaning.

5. SSPC-SP 6 (2004): Commercial Blast Cleaning.

6. SSPC-SP10 (2004): Near-White Blast Cleaning.

B. American National Standards Institute (ANSI):

1. A13.1 (1996): Scheme for the Identification of Piping Systems, Designation.

1.4 QUALITY ASSURANCE

A. Provide in accordance with Section 014000 and as specified.

B. Use products of one manufacturer in any one paint coating system with compatible coating materials. Provide same coating product for touch-up as for original coating.

C. Do not use or retain contaminated, outdated, or diluted materials for painting. Do not use materials from previously opened containers.

D. Provide materials having equal quality of products of manufacturers listed in paragraph 2.4.

E. Provide paint products having a minimum of five (5) years of service, with no peeling, flaking, chipping, blistering, or fading, under similar service conditions.

F. The following information shall be included on the label of all containers of material supplied under this item.

1. Manufacturer’s name.

2. Type of paint or other generic identification.

3. Manufacturer’s stock number.

4. Manufacturer’s shelf life and expiration date.

5. Color.

6. Instructions for mixing, thinning or reducing (as applicable).

7. Manufacturer’s application instructions.

8. Safety and storage information.

1.5 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 013300, “Submittal Procedures”:

1. List of coating products (Paint Schedule) with brand, type and manufacturer including dry film thickness and volatile organic compound (VOC.) regulations conforming to these specifications. Refer to paragraph 2.4.

2. Manufacturer's current printed recommendations and product data sheets for each including performance criteria, surface preparation, mixing and application instructions and product care.

3. Product data and pertinent information (test patches also) indicating compatibility of field coatings to be applied over shop applied coatings. Include a schedule listing each primer

with field applied coating to be applied over the shop coating.

4. Color chip samples of materials proposed and matching color of coatings indicated in Finish Schedule.

5. Color chip samples matching colors indicated in Piping Identification Schedule, attached to this specification. Submit list of piping (Pipe Identification Schedule) to be included under each color. Submit information for pipe legend, sizes nomenclature, locations conforming to ANSI 13.1 for stencils or labels.

6. Submit manufacturer's published data showing service record specified in paragraph 1.1 E.

7. Submit letter(s), signed by Contractor, stating that surfaces to be coated are ready for preparation as specified in paragraph 3.2 B.

8. Product data for mil thickness testing equipment including operating instructions.

9. Approved mil thickness test results, including location, and surface or item identification.

10. Submit letter(s) signed by Contractor, certifying that surfaces to be coated have been prepared in accordance with paint manufacturer's printed instructions and are ready for field paint application.

11. Submit letter(s) signed by paint manufacturer certifying that submitted products are suitable for application on the surfaces to be coated and for the service conditions.

1.6 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL

A. Store paints and painter's materials only in area or areas approved by the Engineer solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.

B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.

1. Transport water to paint area by temporary hose or piping.

2. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours. Dispose hazardous materials and non-hazardous waste in accordance with the applicable requirements specified in Division 1.

1.7 DELIVERY, HANDLING, STORAGE, PROTECTION

A. All applicable health, safety and fire regulations controlling the storage of paint and related materials shall be strictly adhered to. All materials shall be stored and handled in accordance with the manufacturer's printed recommendations.

B. Provide a minimum of five (5), 10 lb., portable fire extinguishers located in the designated paint storage area. Extinguishers shall be suitable and capable of extinguishing any fire occurring in the storage area and for the generic types of paint specified herein.

C. Deliver materials to painter's area in original, unbroken containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.

D. Store coated items and protect coatings from damage and foreign matter, by not allowing contact with soil or pavement, exposure to the elements and UV degradation, exposure to wind-blown

particles, or other harmful contacts which necessitate special cleaning. Use blocking during storage.

E. Do not expose primed surfaces to weather for more than two months before top coating. Allow less open time as recommended by coating manufacturer.

F. Protect coated items, whether prime or finish, from damage due to shipping and handling. For handling coated items use padding, blocking, and fabric slings.

1.8 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's printed recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply coatings when dust is being generated.

B. Protection:

1. Cover or otherwise protect finish work of other trades and surfaces not being painted concurrently or not to be painted.

2. Do not paint over nameplates, tagging or other identification devices.

1.9 MANUFACTURER'S TECHNICAL REPRESENTATIVE DURING PAINTING OPERATIONS

A. Provide the services of an authorized technical representative of the paint coating manufacturer present at the start-up and weekly during painting operations. Such technical representative shall observe and instruct the Contractor's workmen with regard to surface preparation, mixing and application instructions and at completion of the work, shall certify in writing that these manufacturer's instructions have been adhered to.

B. Cost of this work shall be at the expense of the Contractor.

1.10 TESTING EQUIPMENT

A. Furnish testing equipment for use in determining the total dry film thickness specified in this section for all surfaces and in accordance with SSPC- PA-2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tnemec Co., Inc., Kansas City, MO.

B. The Valspar Corp., Baltimore, MD.

C. Kop-Coat, Inc., St. Louis, MO.

D. Sherwin-Williams, Cleveland, OH.

E. Or approved equal.

2.2 MATERIALS - GENERAL

A. Paint Coatings:

1. High build, high performance paint coatings as recommended by the manufacturer for their intended service.

2.3 COLORS AND FINISHES

A. Contractor shall submit to the Engineer for review, color selection cards for all paints, and stains he proposes to use. Only those colors which have been accepted by the Owner shall be utilized in work covered by this specification section.

B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.

C. Unless otherwise indicated for finish paint, use gloss or semi-gloss on metal.

2.4 COATING TYPES

A. Coatings are described in the COATINGS IDENTIFICATION SCHEDULE by generic type, minimum solids by volume, minimum dry film thickness and abbreviations used in the PAINT SCHEDULE. Provide coatings that comply with the volatile organic compounds (VOC) regulations applicable to the project site and in no case to exceed 3.5 lbs/gal.

COATING IDENTIFICATION SCHEDULE

ABBR.	Generic Type	Solids By Vol. (%) **	DFT Thickness (Per Coat)	Manufacturers		
				TNEMEC	VALSPAR	KOP-COAT
AL	Emulsified Acrylic	43	2.0-3.0	Series 6	Series 42	Kop-Coat 600
APE	High Build Acrylic Polyurethane Enamel	74	3.0-5.0	Series 73/74 Endurashield	Series 54	Kop-Coat 1122 High Solids
EP	Polyamide Epoxy	62	3.0.-4.0	Series 161	Series 76	340 Gold Primer
PE*	Polyamide Epoxy	69	5.0-7.0	Series 161	Series 89	Hi-Gard
PVA	Vinyl-Acrylic Latex	28	2.0-3.0	51-792 PVA Sealer	Series 79-W-1	Glamour-glaze Wallboard Primer

* If application of PE type coating occurs during low temperatures, provide and apply LTE type coating in lieu of PE and substitute throughout in Paint Schedule at end of Section, unless otherwise recommended by coating manufacturer.

* * Solids by volume based on Tnemec Coatings

2.5 OSHA SAFETY COLOR USAGE GUIDE

A. OSHA Safety colors in accordance with ANSI Z53.1 shall be used for marking physical hazards, safety equipment and their locations. The following OSHA Safety Color Usage Guide will be provided and used in determining the coating color and type of marking required. Do not proceed until final approval for this work has been approved by the Engineer.

1. Safety Red.

a. Fire protection equipment.

b. Fire boxes.

c. Extinguishers.

d. Exit signs.

e. Portable containers of flammable liquids.

f. Emergency stop bars.

g. Equipment motors and guards.

2. Safety Orange.

a. Exposed box housings.

b. Exposed edges of pulleys, gears, hoisting equipment, etc.

c. Safety starting buttons.

3. Safety Yellow - Physical Hazard (Caution-Generally used with black in checks or stripes).

a. Unguarded edges of platforms.

b. Bollards and guard posts.

c. Monorail beams.

d. Concrete equipment bases.

4. Safety Green - Safety Equipment and Locations.

a. First aid kits and stretchers.

b. First aid signs, dispensaries, and drinking water stations.

PART 3 - EXECUTION

3.1 HOISTING, SCAFFOLDING, STAGING AND PLANKING

A. Provide, set-up, and maintain all required derricks, hoisting machinery, scaffolds, and staging and planking, and perform all hoisting required to complete work of this section as indicated and specified.

B. Scaffolds shall have solid backs and floors to prevent dropping materials to the floors or ground.

3.2 INSPECTION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an approved condition through preparatory work.

B. Do not proceed with surface preparation or coating application until after submitting to the Engineer a letter signed by Contractor, and the paint manufacturer's technical representative, stating that the particular surfaces to be painted are in acceptable condition for preparation and

coating.

C. Clean and paint before assembly, surfaces inaccessible after assembly, unless such areas are seal welded.

3.3 PREPARATION

A. Basic Steps:

1. Conform to manufacturer's printed instructions for safety requirements for all phases of field painting work.

2. Prepare and paint surfaces in heated enclosure unless the ambient weather conditions include still air above 50 deg. F. temperature and humidity above manufacturer's printed recommended level. Do not apply paints to surfaces in direct sunlight.

3. Coordinate cleaning and painting operations to eliminate contamination of one by the other.

4. Maintain coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.

5. Coordinate materials to be applied with previous coatings on affected surfaces. Obtain, in all cases, manufacturer's written directions, and follow them strictly, except where otherwise specified.

6. Coordinate preparation and material compatibility requirements with the work (shop painting).

B. Before any paint application, clean surfaces to be coated of dust, dirt, grease, loose rust, mill scale, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or similar conditions detrimental to coating bond and durability.

1. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.

2. Fill imperfections and holes in surfaces to be painted with material recommended by paint manufacturer.

C. Metals:

1. Prepare ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:

a. Near White blast cleaned (SSPC-SP-10), for Type S service (Refer to Section 09940 for service types).

b. Commercial blast cleaned (SSPC-SP-6), for Type E service (Refer to Section 09940 for service types).

c. Use needle gun for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface, followed by SSPCSP1-solvent wipe.

2. Clean ferrous metals with shop primers as previously specified, then:

a. Prepare surface to meet manufacturer's printed recommendations for Type E or S

service (Refer to Section 099400 for service types).

3. Epoxy coated metals for paint finish: Clean of dirt, grease, oil and foreign matter.

4. Non-ferrous and galvanized metal surfaces for finish: Clean of dirt, grease, oil, and foreign substances, wash thoroughly with grease solvent, then permit to dry. Apply one coat of epoxy primer (EP) to non-ferrous surfaces.

D. Provide higher degree of cleaning for acceptable equivalent paint products when paint manufacturer recommends in his printed surface preparation recommendations.

E. Delay painting of areas which will be damaged by heat from welding, until welding is complete. Reclean and recoat substrate as specified for original coats, when coated areas have been damaged by welding or have not been painted to allow welding.

3.4 TOUCH-UP

A. Before applying field coat, touch-up abraded areas of shop coats with paint of the same type. Apply an entire coat to abraded area. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces to bare metal before applying touch-up coat.

B. Instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touch-up scratches and blemishes before applying field coats.

3.5 APPLICATION

A. Apply a minimum of one under coat and finish coat to previously primed surfaces. Following careful inspection of surfaces not previously primed, prepare and clean as specified, apply prime coat, one under coat, and one finish coat. Refer to Paint Schedule at end of this specification for coating requirements. Provide additional prime, under, and finish coats as specified, indicated, and recommended by coating manufacturer's printed instructions.

B. Conditions:

1. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing.

2. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.

3. Coat blast cleaned metal surfaces in accordance with applicable SSPC guidelines, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning.

C. Methods:

1. Spraying with apparatus may be substituted for brush application of paints in locations approved for spraying by the Engineer and paint manufacturer's technical representative.

2. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.

3. Protect surfaces to be coated, before, during and after application.

D. Workmanship:

1. Apply spot prime of aluminum paints to exposed nails and other ferrous metal on surfaces to be painted with water-thinned paints.

2. Apply coating materials to meet manufacturer's spreading rate and dry film thickness specified. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.

   a. Control thinning in accordance with VOC regulations for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.

   b. Record quantities of materials of each type, for each coat, used in each location.

3. Apply paints and coatings using painters continuously employed in the painting profession for no less than five (5) years within the last five (5) years. Apply paints and coatings brushed or rolled out carefully to a smooth, even coating without runs or sags. Flow enamel on evenly and smoothly. Allow each coat of paint to dry throughout the film thickness, before the next coat is applied. High polymer coatings may be excepted from the drying requirement if recoat time is specified by manufacturer.

4. Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.

3.6 PROTECTION AND CLEAN-UP

A. Protect surfaces to be painted or coated under this Section as follows:

1. Arrange for preparation and coating activities to be performed in areas and during times when no continuous traffic and no dust generating activity will be present.

2. During time between preparation and coating, protect work from dust and dirt with dropcloth. Do not allow contact with surfaces in this time period.

3. During painting activity, clearly mark the area being used by painters to prevent interference with painting being applied as specified.

4. After painting, clearly barricade painted surfaces with cones, plastic barrier tape, or other visible barrier. Locate "WET PAINT" signs near painted surfaces. Do not remove barriers and signs until paint surface dries throughout entire film thickness.

B. Remove or completely mask accessory items, finish hardware, lighting fixtures, escutcheon plates, trim and similar finish items not to be painted before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.

C. Upon completion of the work, clean up paint spots, oil, and stains from floors, glass, hardware, and similar finished items and remove tape.

3.7 ITEMS NOT TO BE FIELD PAINTED

A. The following items with their respective specification section number will not require field painting, unless otherwise noted:

1. Division 23: Heating, Ventilation and Air Conditioning Equipment.

   a. All equipment except piping valves, meters and fittings will be delivered with factory-applied, finish paint and will not require field painting, but will require field touch-up

after installation. Touch-up material and labor will be provided by Contractor. Contractor shall paint HVAC piping, valves, meters and fittings as specified herein.

3.8 SCHEDULE OF PAINTING

A. Coordinate and schedule the various cleaning, touch-up and finishing operations. Transmit and coordinate the transmission of materials data, color selections and coating system methods between the coating applicators. Do not exceed exposure and recoat time limits.

PAINT SCHEDULE

Item No.	Surface or Item	Field Coats		
		1st	2nd	Final
1	Ferrous piping, fittings, and piping supports, valve handles, hydrants, floor stands, and operating devices and supports, guard posts.	EP	PE	APE
2	Emulsified asphalt-coated ferrous piping.	AL		AL
3	Guard posts and bollards.	EP	PE	APE
4	Ferrous metal surfaces of support framing for Odor Control Ductwork	PE		PE
5	Exterior exposed equipment with Type E service prime coats. (Note 1 and 2)	EP	PE	APE
6	Items with complete factory finish (Primer and topcoats).	Touch-up with materials supplied by manufacturer		
7	Exterior and interior insulated pipes	PVA	AL	AL
8	Shop painted items specified in Division 23, 33 and 44 that are interior and are submerged and non-submerged, including exterior submerged items. (Note 2)	Touch-up with similar material		PE
9	Shop painted items specified in Division 23, 33 and 44 that are exterior and non-submerged (Note 2)	Touch-up with similar material		APE

Notes:

1. Type of service is specified in Section 099400.
2. If prime coat has been exposed for more than 6 months, Contractor will provide test patches to insure adhesion of field-applied coatings. Test patches in accordance with paint manufacturer's instructions

3.9 FINAL TOUCH-UP

A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish areas to leave touched-up areas with same appearance as and even with the surrounding finish specified.

B. After doors have been fitted and hung, refinish edges, tops and bottoms.

3.10 TESTING

A. Conduct field testing in the presence of the Engineer for specified mil thickness in accordance with SSPC-PA-2.

B. Test results shall meet requirements of SSPC-PA-2. Failure of test results shall require that surfaces be repainted until approved results of testing have been obtained for the specified mil thickness.

3.11 CONTRACT CLOSEOUT

A. Provide in accordance with Section 017700.

END OF SECTION

SECTION 096700

EPOXY FLOORING

PART 1 – GENERAL

1.1 SUMMARY:

A. Work of this section includes a four-component, environmentally friendly, troweled epoxy mortar system utilizing 30-percent recycled glass and rapidly renewable additives.

1.2 REFERENCES:

A. ASTM International (ASTM):
1. C307 Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
2. C413 Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
3. C531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
4. C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
5. C580 Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
6. C811 Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings.
7. D2240 Standard Test Method for Rubber Property – Durometer Hardness.
8. D2369 Standard Test Method for Volatile Content of Coatings.
9. D2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
10. E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
11. F1679 Standard Test Method for Using A Variable Incidence Tribometer (VIT).
12. F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
13. F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS:

A. Product data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for verification: For each resinous flooring system required, 6-inch square, applied to a rigid backing by Installer for this Project.

C. Installer certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Maintenance data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY CONTROL:

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems in similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

B. Source limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer or primary materials.

C. Manufacturer field technical service representatives: Resinous flooring manufacturer shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project. Field Technical Services Representatives shall assist in the quality control and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch square floor area selected by the Construction Manager.
   2. Include 48-inch length of integral cove base.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-Installation conference:
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. General Contractor
      b. Authority's Representative.
      c. Manufacturer/Installer's Representative.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and direction for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.6 JOB-SITE CONDITIONS:

A. Environmental limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Maintain material and substrate temperature between 65- and 85-degrees F (18- and 30-degrees C) during resinous flooring application and for not less than 24 hours after application.

C. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

D. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

E. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise an osmotic pressure resistant grout must be installed prior to the resinous flooring

1.7 WARRANTY:

A. Installer and flooring manufacturer shall jointly warranty flooring material and application for a period of 3 years, for its normal and intended use; should flooring need repair or replacement, Authority will incur no cost for repair or replacement. Warranty shall begin on Date of Substantial Completion.

2 PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable manufacturers:
1. Basis of design: Stonhard, Inc.; Stonclad GR with Stonkote GS4
2. Dexotex, Div. of Crossfield Products Corp.
3. General Polymers Corp.
4. Selby, Div. of Degussa Building Systems.
5. Tnemec Co., Inc.

B. Build up of broadcast or liquid rich (slurry) type systems will not be accepted.

2.2 EPOXY FLOORING SYSTEM:

A. System Characteristics:
1. Color and pattern: Select from manufactures standards.

2. S Texture #2. Field verify.
3. Integral cove base: 4”.
4. Overall system thickness: Nominal 1/4".

B. Physical properties:
1. Flammability: ASTM E648-10, Class I.
2. Hardness: 85-90 when tested in accordance with ASTM D2240-05, Shore D.
3. Water absorption: ASTM C413-01 (2006), 0.2-percent.
4. Abrasion resistance: ASTM D2794-93 (2004), 0.1 grams per minute maximum weight loss.
5. Impact resistance: ASTM D2794-93 (2004), > 160 inches/pounds
6. Compressive strength: 10,000 minimum when tested after 7 days in accord with ASTM C579-01 (2006).
7. Tensile strength: 1,650 pounds per square inch when tested in accord with ASTM C307-03 (2008).
8. Flexural strength: 4,000 pounds per square inch minimum when tested in accord with ASTM C580-02 (2008).
9. Coefficient of friction (Dry): 0.83 when tested in accord with ASTM F1679-2006.
10. Slip resistance index (Wet): 0.66 when tested in accord with ASTM F1679-2006.
11. Thermal coefficient of expansion: 15 x 10-to-the- (-6) when tested in accord with ASTM C531-11 (2005) in/in/degree C.
12. Flexural modulus of elasticity: 2.0 x 10-to-the- (-6) when tested in accord with ASTM C580-02 (2008).
13. Heat resistance limitation: 140-degrees F / 60-degrees C (continuous exposure) 200-degrees F / 93-degrees C (intermittent spills).
14. Cure rate: 24 hours for normal operations.
15. VOC content: 0 grams per liter per ASTM D2369-07.

C. System components: Manufacturer’s standard components that are compatible with each other and as follows:
1. Body coat(s):
   a. Resin: Epoxy.
   b. Formulation description: 100 percent solids.
2. Application method: Metal trowel.
   a. Thickness of coats: 3/16” to 1/4".
   b. Number of coats: One.
3. Aggregates: Containing 30-percent recycled glass and rapidly renewable additives.
4. Topcoats: Stonkote GS4, general service sealing.
   a. Resin: Epoxy.
   b. Formulation description: 100 percent high solids.
   c. Type: Pigmented.
   d. Finish: Texture 2, unless noted otherwise.
   e. Number of coats: One.

2.3 ACCESSORY MATERIALS:

A. Primer: type recommended by manufacturer for substrate and body coats indicated.
1. Basis of design for formulation description: Stonhard Standard Primer, 100 percent solids.

B. Waterproofing membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.

1. Basis of design; only if application above grade: Stonproof ME7.

C. Patching and fill material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated. Resinous based materials only. Cementitious or single component products not accepted.

D. Joint sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

3 PART 3 - EXECUTION

3.1 PREPARATION:

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry and neutral Ph substrate for resinous flooring application.

B. Concrete substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Mechanically prepare substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      b. Comply with ASTM C811-99 (2008) requirements, unless manufacturer's product data is more stringent.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's product data.

C. Verify that concrete substrates are dry.
   1. Perform in situ probe test, ASTM D 2170-02. Proceed with application only after substrates fo not exceed a maximum potential equilibrium relative humidity of 85 percent.
   2. Perform anhydrous calcium chloride test, ASTM F1869-10. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5-pounds of water/1000 square feet of slab in 24 hours.
   3. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
   4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous materials: Mix components and prepare materials according to resinous flooring manufacturer's product data.

E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's product data.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.
   1. Basis of design: Stonflex MP7 joint fill material, and/or Stonproof CT5 concrete crack treatment.

3.2 APPLICATION:

A. General: Apply components of resinous flooring system according to manufacturer's product data to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's product data.
      a. Apply joint sealant to comply with manufacturer's product data.

B. Apply primer where required by resinous system, over prepared substrate at spreading rate recommended by manufacturer's product data.

C. Integral cove base: Stonclad GS mortar, apply cove base mix to wall surfaces before applying flooring. Apply in accord with manufacturer's product data and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
   1. Integral cove base: 4: high.

D. Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

E. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended by manufacturer's product data.

3.3 FIELD QUALITY CONTROL:

A. Material sampling: Owner may at any time, and for any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, and reapply flooring materials to comply with requirements.

3.4 CLEANING, PROTECTING, AND CURING:

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

SECTION 22 11 00

DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Domestic water piping, above grade.
2. Unions and flanges.
3. Ball valves.
4. Check Valves.
5. Pipe hangers and supports.
6. Water pressure reducing valves.
7. Backflow preventers.
8. Hose bibs
9. Instantaneous water heaters
10. Emergency eyewash.

1.2 SUBMITTALS

A. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and equipment.

B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.4 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

B. Perform Work in accordance with State and Local codes.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Furnish one year manufacturer warranty for domestic water piping.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

   2. Alloy Grade Sn95 tin-silver, lead free solder

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Copper Piping: Class 150, bronze unions with soldered ends.
   2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 BALL VALVES

A. Manufacturers:
   1. Equal to NIBCO, Inc.

B. 2 inches and Smaller: MSS SP 110, Class 150 , bronze, two piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends and lever handle.

C. 2 inches and Smaller: MSS SP 110, Class 150, bronze, three piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends and lever handle.

2.4 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:
   a. Equal to NIBCO, Inc.

2.5 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Equal to Carpenter & Paterson Inc

B. Plumbing Piping: Conform to ASME B31.9.

C. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

D. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

E. Vertical Support: Steel riser clamp.

F. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

2.6 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Equal to Watts.

B. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, double union ends.

2.7 BACKFLOW PREVENTERS

A. Manufacturer shall be equal to Watts.

B. Comply with ASSE 1013.

C. Bronze body, with bronze internal parts and stainless steel springs.

D. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.8 HOSE BIBS

A. Interior (HB-1): Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, with hand wheel, integral vacuum breaker in conformance with ASSE 1011.

B. Exterior (NFPH-1): Exposed, non-freeze post hydrant shall be complete with galvanized steel casing and cast aluminum casing guard, all bronze interior parts, bronze seat and replaceable seat washer, and non-turning operating rod with free-floating compression closure valve with 1-inch connection. Hydrant shall be equipped with a tapped ¼-inch drain port in valve housing.

2.9 INSTANTANEOUS WATER HEATERS

A. Instantaneous Water Heater shall have digital microprocessing temperature control capable of maintaining outlet temperature of +/- 1°F accuracy. Unit shall be UL listed with a replaceable, cartridge-style heating element. Heating element shall be iron free, nickel-chrome material. Furnish a filter in the inlet connector that shall also be replaceable. Heater shall be fitted with 1/2" pipe compression nuts (5/8" OD) or 3/8" sleeves, to eliminate need for soldering. Maximum operating pressure shall be 150 PSI. Unit shall be equal to Eemax.

2.10 EMERGENCY EYEWASH

A. Pedestal mounted, freeze resistant eye wash with stainless steel bowl, schedule 40 galvanized pipe and fittings, powder coated cast aluminum flag handle and floor flange, and ¾" IPS stay open bury valve (36" standard bury depth) with ¼" IPS bleed outlet. Unit shall have (2) polypropylene 'GS Plus' spray heads with integral flip-top dust covers, filters and 1.8-GPM flow control orifices mounted on a chrome plated brass eyewash assembly. Unit shall include ANSI compliant sign.

B. Performance: Unit shall be hydrostatically tested to meet or exceed ANSI Z358.1 – 2004 and shall have a full 2-year warranty.

C. Fixture shall be equal to Guardian Equipment GFR1825

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:

1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not accessible. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

I. Install domestic water piping in accordance with ASME B31.9.

J. Sleeve pipes passing through partitions, walls and floors.

K. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

L. Install unions downstream of valves and at equipment or apparatus connections.

M. Install valves with stems upright or horizontal, not inverted.

N. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

O. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

P. Install potable water protection devices on plumbing lines where contamination of domestic water may occur.

Q. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

R. Test backflow preventers in accordance with ASSE 5013 or 5015.

3.4 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with applicable Code.

3.5 CLEANING

A. Prior to starting work, verify system is complete, flushed and clean.

B. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 19
AUTOMATIC PIT EVACUATOR

PART 1 GENERAL

1.1 SUMMARY

A. Provide a recirculation system for each pump station from the discharge side of the dry pit submersible pumps to the wet well using a venturi pressure system to agitate solids in the sewage to eliminate sludge and grease build up in the wet well.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit installation details for pumps, piping, and components.

C. Product Data: Submit data for specified Products.

PART 2 PRODUCTS

2.1 PIT EVACUATOR

A. Automatic pit evacuator shall be a pressurized equipment component capable of agitating the solids contents of sewage to minimize sludge build up on the wet well floor and eliminate grease build up.

B. Pit evacuator shall be Model ‘A’ as manufactured by Waste Tec Solutions or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install system as shown on the Drawings but Contractor shall make modifications to the layout as required to avoid conflicts.

B. Provide necessary piping, equipment, and valves as indicated on Drawings.

3.2 FIELD QUALITY CONTROL

A. Upon completion of installation, examine adjust and test each system for proper operation.

END OF SECTION

SECTION 22 14 29

SUMP PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sump pumps.

1.2 DESIGN REQUIREMENTS

A. Design Criteria:
1. Refer to the schedule on the Drawings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Submit installation details for pumps, piping, controls and accessories including wiring schematics.

C. Product Data: Submit data for specified Products.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Prepare pumps and accessories for shipment to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 SUMP PUMPS

A. Manufacturer shall be equal to Zoeller Pump Company.

B. Impeller: Cast iron, semi-open, non-clog.

C. Casing: Cast iron.

D. Mechanical Seal: Silicon carbide.

E. Shaft: Stainless steel.

F. Designed for continuous operation.

G. Bearings: Upper and lower heavy duty ball bearings.

2.2 PUMP MOTORS

A. Fully submerged in high-grade turbine oil for lubrication and efficient heat transfer.

B. Power Cable: Severe duty rated, oil and water resistant, epoxy seal on motor end.

C. Built-in overload with automatic reset.

D. Class B insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connections, size, and location are as indicated on Drawings.

3.2 INSTALLATION

A. Install sump pumps in accordance with Drawings and manufacturer's instructions.

B. Provide necessary piping, fittings, and valves as indicated on Drawings.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Upon completion of installation, examine, adjust and test each pump for proper operation.

C. Test each pump with clean water through minimum of four complete cycles.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Testing Agency: Company specializing in testing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. Manufacturers: Equal to Eaton Corporation.

B. Motors 3/4 hp and Larger: Three-phase motor as specified below.

C. Motors Smaller Than 3/4 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

D. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
   1. Voltage: As indicated on Drawings.
   2. Service Factor: 1.25As indicated on Drawings.
   3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
   4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   5. Insulation System: NEMA Class F.
   6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
   7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
   8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
   9. Sound Power Levels: Conform to NEMA MG 1.

E. Single Phase Motors:
   1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
   2. Voltage: As indicate on the drawings.

F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned motors

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Install engraved plastic nameplates in accordance with Section 26 05 53.

C. Ground and bond motors in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vibration isolators.
2. Ductwork lagging.

B. Related Sections:
1. Section 07 90 00 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
2. Section 08 91 00 - Louvers: Product requirements for acoustic wall louvers.
3. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Product requirements for anchors and piping expansion compensation.
4. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
5. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
6. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:
1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

C. Air-Conditioning and Refrigeration Institute:
1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

D. American Society of Heating, Refrigerating and:
1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
2. ASHRAE Handbook - HVAC Applications.

E. ASTM International:
1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.

F. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

B. Provide minimum static deflection of isolators for equipment as follows:
   1. Upper Floors, Normal
      a. 400 - 600 rpm: 3.5 inch
      b. 600 - 800 rpm: 2 inch
      c. 800 - 900 rpm: 1 inch
      d. 1100 - 1500 rpm: 0.5 inch
      e. Over 1500 rpm: 0.2 inch

C. Use concrete inertia bases for fans having static pressure in excess of 3.5 inches water column or motors in excess of 40 hp, and on base mounted pumps over 10 hp.

D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

E. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook., HVAC Applications.
   1. Offices
      a. Executive: 30
      b. Conference rooms: 30
      c. Private: 35
      d. Open-plan areas: 35
      e. Computer/business machine areas: 40
      f. Public circulation: 45

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.

F. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

G. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

H. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AMCA 300 standards and recommendations of ASHRAE 68.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Open Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

B. Restrained Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   5. Restraint: Furnish mounting frame and limit stops.

C. Closed Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
   3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.

D. Restrained Closed Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
   3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

E. Spring Hanger:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators rubber hanger with threaded insert.
   4. Misalignment: Capable of 20 degree hanger rod misalignment.

F. Neoprene Pad Isolators:
   1. Rubber or neoprene-waffle pads.
      a. 30 durometer.
      b. Minimum 1/2 inch thick.
      c. Maximum loading 40 psi.
      d. Height of ribs: not to exceed 0.7 times width.
   2. Configuration: Single layer. 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

G. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

I. Seismic Snubbers:
   1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
   2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
   3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.

4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

2.2 DUCTWORK LAGGING

A. Acoustic Insulation: 2 inch thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.

B. Covering: Sheet lead, plaster or gypsum board with surface weight minimum 4 lb/sq ft.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 EXISTING WORK

A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.

B. Extend existing piping and ductwork installations using materials and methods compatible with existing electrical installations.

3.3 INSTALLATION

A. Lag ductwork, where indicated by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.

B. Attach ductwork to acoustic louvers with flexible duct connections. Refer to Section 23 33 00.

C. Install isolation for motor driven equipment.

D. Bases:
1. Set steel bases for 1 inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

E. Adjust equipment level.

F. Install spring hangers without binding.

G. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

H. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

D. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Tags.
3. Labels.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Samples: Submit two tags, labels, pipe markers, size used on project.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Equal to Craftmark Identification Systems

B. Product Description: Laminated three-layer plastic with engraved white letters on black background color.

2.2 TAGS

A. Plastic Tags:
   1. Manufacturers:
      a. Equal to Craftmark Identification Systems.

   2. Laminated three-layer plastic with engraved white letters on black background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:
   1. Manufacturers:
      a. Equal to Craftmark Identification Systems.
   2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:
   1. Manufacturers:
      a. Equal to Craftmark Identification Systems
   2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

2.3 LABELS

A. Manufacturers:
   1. Equal to Craftmark Identification Systems

B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Identify fan units with plastic nameplates. Identify in-line pumps and other small devices with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Identify ductwork with plastic nameplates. Identify with fan unit identification number and area served.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preliminary testing of air systems
   2. Final test of air system
   3. Testing, adjusting, and balancing of air systems.

1.2 REFERENCES

A. Associated Air Balance Council:
   1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

1.3 SUBMITTALS

A. Prior to commencing Work, submit proof of latest calibration date of each instrument.

B. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.

D. Submit draft copies of report for review prior to final acceptance of Project.

E. Furnish report of preliminary test of air system prior to the start of renovations. Include a reduced drawing showing the test locations.

F. Furnish reports complete with table of contents page and indexing tabs, with cover identification. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and rough setting.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report for inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years of experience and certified by AABC.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer or registered professional engineer experienced in performance of this Work and licensed in the State of Georgia.

PART 2 PRODUCTS

A. Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Volume dampers are in place and open.
   7. Access doors are closed and duct end caps are in place.
   8. Air outlets are installed and connected.
   9. Duct system leakage is minimized.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

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

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Record air flow, pressures and temperature measurements in the supply duct to the designated space before and after balancing airflows in the space.

B. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

C. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

F. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

G. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

H. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

I. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

J. Adjust exhaust dampers for design conditions.

3.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Air Outlets
   2. Exhaust fans
   3. Supply fans
   4. Supply fan control dampers
   5. Odor control fans
   6. Electric duct heaters

B. Report Forms

1. Title Page:
    a. Name of Testing, Adjusting, and Balancing Agency
    b. Address of Testing, Adjusting, and Balancing Agency
    c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
    d. Project name
    e. Project location
    f. Project Architect
    g. Project Engineer
    h. Project Contractor
    i. Project altitude
    j. Report date
2. Summary Comments:
    a. Design versus final performance
    b. Impact of new tenant HVAC requirements on exiting HVAC system
    c. Notable characteristics of system
    d. Description of systems operation sequence
    e. Nomenclature used throughout report
    f. Test conditions
3. Instrument List:
    a. Instrument
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Range
    f. Calibration date
4. Electric Motors:
    a. Manufacturer
    b. Model/Frame
    c. HP/BHP and kW
    d. Phase, voltage, amperage; nameplate, actual, no load
    e. RPM
    f. Service factor
    g. Starter size, rating, heater elements
    h. Sheave Make/Size/Bore
5. Heating Coil Data:
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Air flow, design and actual
    f. Water flow, design and actual
    g. Entering air temperature, design and actual
    h. Leaving air temperature, design and actual
    i. Air pressure drop, design and actual
6. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure

h. Discharge pressure
i. Fan RPM

7. Duct Traverse:
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   i. Air temperature
   j. Air correction factor
8. Duct Leak Test:
   a. Description of ductwork under test
   b. Duct design operating pressure
   c. Duct design test static pressure
   d. Duct capacity, air flow
   e. Maximum allowable leakage duct capacity times leak factor
   f. Test apparatus
      1) Blower
      2) Orifice, tube size
      3) Orifice size
      4) Calibrated
   g. Test static pressure
   h. Test orifice differential pressure
   i. Leakage
9. Air Distribution Test Sheet:
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Area factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i. Test (final) air flow
   j. Percent of design air flow

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Control panel enclosures.
2. Hand/Off/Auto switches.
3. Control air dampers.
4. Electric damper actuators.
5. Direct digital control system components.

B. Related Sections:
1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors.
2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
3. Section 23 33 00 - Air Duct Accessories: Product requirements for duct mounted thermometers. Installation requirements for dampers and other duct mounted products furnished in this section.
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASTM International:
1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

D. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. National Fire Protection Association:
1. NFPA 72 - National Fire Alarm Code.
2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
3. NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Coordinate submittals with information requested in Section 23 09 93.

C. Product Data: Submit description and engineering data for each control system component. Include sizing as required.

D. Manufacturer's Installation Instructions: Submit installation requirements for each control component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

C. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Control Air Damper Performance: Test in accordance with AMCA 500.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept controls on site in original factory packaging Inspect for damage.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of control components in duct systems with work of Section 23 33 00.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 CONTROL COMPONENT MANUFACTURERS

A. Manufacturers:

1. Honeywell, Building Control Solutions.
2. Johnson Controls, Inc.
3. Siemens Building Technologies, Inc.

2.2 CONTROL PANEL ENCLOSURES

A. Furnish for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. Construction: NEMA 250, Type 4 fiberglass or stainless steel enclosure.

C. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.

2.3 HAND/OFF/AUTO SWITCHES

A. Provide hand/off/auto switches with NEMA 4 enclosures. Voltage rating of devices shall be coordinated to match requirements of associated equipment.

2.4 CONTROL AIR DAMPERS

A. Performance: Test in accordance with AMCA 500.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.

C. Blades: Galvanized steel, maximum blade size 6 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

E. Jamb Seals: Stainless steel spring.

F. Shaft Bearings: Graphite impregnated nylon sleeve, with thrust washers at bearings.

G. Linkage Bearings: Graphite impregnated nylon.

H. Outside Air Damper Leakage: Maximum leakage rate of 3.0 cfm per square foot at 1.0 inches wg pressure differential.

I. Recirculation Damper Leakage: Less than one percent based on approach velocity of 2000 fpm and 4 inches wg.

J. Maximum Pressure Differential: 6 inches wg.

K. Temperature Limits: - 40 to 200 degrees F.

2.5 ELECTRIC DAMPER ACTUATORS

A. Operation: Two-position, spring-return. See Drawings to identify normally closed arrangement.

B. Enclosure Rating: NEMA 250 Type 4.

C. Mounting: Direct mount.

D. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return.

E. Protection: Electronic stall protection.

F. Control Input: 0-10 VDC or 0-20 mA DC.

G. Power: Nominal 120-volt AC.

H. Torque: Size for minimum 150 percent of required duty.

I. Duty cycle: rated for 65,000 cycles.

J. Accessories:
   1. Cover mounted transformer.
   2. Auxiliary potentiometer.
   3. Damper linkage.
   4. Direct drive feedback potentiometer.
   5. Output position feedback.
   6. Field selectable rotational, spring return direction, field adjustable zero and span.
   7. End switch.

2.6 DIRECT DIGITAL CONTROL SYSTEM COMPONENTS

A. Temperature Sensors:
   1. Type: Resistance temperature detector (RTD) or thermistor.
   2. Accuracy:
      a. Plus or minus 0.2 degree F.
      b. Sensing Accuracy: Plus or minus 0.1 degree F.
      c. Display Accuracy and Resolution: Minimum of plus or minus 0.1 degree F.
   3. Built-in communications port.
   4. Duct Temperature Sensors:
      a. Rigid or averaging type as indicated in sequence of operations. Averaging sensor minimum length: 5 feet in length.
      b. Duct Cross Sections Greater Than 10 square feet: Furnish serpentine averaging element to sense stratified air temperatures.

B. Air Flow Switches:
   1. Paddle or differential pressure type, as indicated in sequences of operation.
   2. UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum).
   3. Appropriate scale range and differential adjustment.
   4. Adjustable sensitivity.
   5. NEMA 250 Type 4 enclosure.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify location of thermostats, temperature sensors and other devices with Drawings before installation.

C. Verify building systems to be controlled are ready to operate.

3.2 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.3 DEMONSTRATION AND TRAINING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate complete operation of systems, including sequence of operation prior to Date of Substantial Completion.

C. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section includes control equipment and software.

B. Related Sections:
1. Section 23 09 00 - Instrumentation and Control for HVAC: Control system components.
2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
3. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI MC85.1 - Terminology for Automatic Control.

1.3 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor based units.

B. Provide controls for fans and motorized outside and return air dampers.

C. Provide control systems consisting of temperature sensors, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

D. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate the following:
1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
2. Connected data points, including connected control unit and input device.

C. Product Data: Submit data for each system component and software module.

D. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Submit data specified in "Submittals" in final "Record Documents" form.

C. Operation and Maintenance Data:
   1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 DIRECT DIGITAL CONTROLS

A. Manufacturers shall be equal to:
   1. Honeywell;
   2. Johnson Controls; or
   3. Siemens.

B. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

C. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

D. Control Units Functions:
   1. Monitor or control each input/output point.
   2. Completely independent with hardware clock/calendar and software to maintain control independently.
   3. Acquire, process, and transfer information to operator station or other control units on network.
   4. Accept, process, and execute commands from other control unit's or devices or operator stations.
   5. Access both data base and control functions simultaneously.
   6. Perform in stand-alone mode:
      a. Start/stop.
      b. Duty cycling.
      c. Automatic Temperature Control.
      d. Scanning and alarm processing.
      e. Full direct digital control.
      f. Global communications.

E. Global Communications:

1. Generate discrete outputs for fan status available for use by other facility control and monitoring systems.

F. Input/output Capability:
1. Discrete/digital input (contact status).
2. Discrete/digital output.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field end devices and wiring are installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install with 120 volts alternating current, 15 amp dedicated emergency power circuit to each programmable control unit.

C. Install conduit and electrical wiring in accordance with Section 26 05 03.

D. Install electrical material and installation in accordance with appropriate requirements of Division 26.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Pump room heating and ventilation system.

B. Related Sections:
   1. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.
   2. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PUMP ROOM VENTILATION SYSTEMS

A. The Pump Room ventilation system for each pump station shall consist of the following equipment and controls components:

EQUIPMENT	PS #1	PS #2	PS #3	PS #4
EXHAUST FAN	EF-101	EF-201	EF-301	EF-401
SUPPLY FAN	SF-101	SF-201	SF-301	SF-401
ELECTRIC DUCT	EDH-101	EDH-201	EDH-301	EDH-401

HTR				
VENTILATION FACTORY CONTROL PANEL	FCP-EF-101	FCP-EF-201	FCP-EF-301	FCP-EF-401
TEMPERATURE SENSOR (OA)	TS-101	TS-201	TS-301	TS-401
TEMPERATURE SENSOR (SA)	TS-102	TS-202	TS-302	TS-402
SUPPLY FAN FLOW SWITCH	FS-101	FS-201	FS-301	FS-401
EXHAUST FAN FLOW SWITCH	FS-102	FS-202	FS-302	FS-402
SUPPLY FAN OA DAMPER	MOD-101	MOD-201	MOD-301	MOD-401
SUPPLY FAN RECIRC DAMPER	MOD-102	MOD-202	MOD-302	MOD-402

B. The supply fan and exhaust fans shall operate constantly to provide ventilation air to each pump station facility to declassify the space from a Class I, Division 2, Group D rating to an Unclassified rating in accordance with National Fire Protection Association Standard 820 for Fire Protection in Wastewater Treatment and Collection Facilities. The equipment systems will operate in accordance with the following sequence:

1. When the HAND/OFF/AUTO switch for FCP-EF-*01 is in the AUTO position and the temperature sensor (TS-*01) registers a temperature of 50 degrees F or HIGHER, EF-*01 shall RUN and an interlock shall engage to START SF-*01 such that both units operate. EF-*01 shall operate at HIGH speed, damper MOD-*01 shall open 100% and MOD-*02 shall CLOSE.

2. When the HAND/OFF/AUTO switch for FCP-EF-*01 is in the AUTO position and the temperature sensor (TS-*01) registers a temperature LOWER than 50 degrees F, EF-*01 shall RUN and an interlock shall engage to START SF-*01 such that both units operate. EF-*01 shall operate at LOW speed; and damper MOD-*01 and MOD-*02 shall each modulate to pass 50% of the total rated air flow for fan SF-*01.

3. When the HAND/OFF/AUTO switch for FCP-EF-*01 is in the HAND position, EF-*01 shall RUN and an interlock shall engage to START SF-*01 such that both units operate. EF-*01 shall operate at HIGH speed, damper MOD-*01 shall open 100% and MOD-*02 shall CLOSE.

4. Whenever the discharge temperature sensor (TS-*02) registers a supply air temperature below 50 degrees F, the electric duct heater (EDH-*01) shall activate via its SCR controller to activate the unit's heating coil to maintain the supply air temperature at 50 degrees F.

5. Whenever the supply fan flow sensor (FS-*01) /or exhaust fan flow sensor (FS-*02) senses a loss of air flow, a FAN FAIL dry contact output signal shall be provided.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Duct Material for HVAC systems
   2. Ductwork fabrication for HVAC systems.

1.2 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.3 SUBMITTALS

A. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 3/8 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Fittings.
   3. Reinforcing details and spacing.
   4. Seam and joint construction details.
   5. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
   6. Product Data: Submit data for duct materials and flexible connectors.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 96 standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Furnish one year manufacturer warranty for ducts.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

B. Fasteners: sheet metal screws.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Provide flexible connectors for mating of fan equipment as indicated on the drawings.

2.2 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

G. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.

1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
2. Do not provide sealing products not bearing UL approval markings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

D. Use double nuts and lock washers on threaded rod supports.

E. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

F. Exhaust Outlet Locations:
1. Minimum Distance from Building Openings: 3 feet.
2. Minimum Distance from Outside Air Intakes: 10 feet.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air terminal units to supply ducts with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.4 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 TESTING

A. For ductwork designed for 3 inches w.c. above ambient, pressure test minimum 25 percent of ductwork after duct cleaning, but before duct insulation is applied or ductwork is concealed.
   1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.

3.6 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel
General Exhaust	Galvanized Steel
Odor Control	See Section 233120

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
General Supply and Exhaust	1-inch w.g. regardless of velocity.

END OF SECTION

SECTION 23 31 20
FIBERGLASS REINFORCED PLASTIC DUCT AND DAMPERS

PART 1 – GENERAL

1.02 SCOPE OF WORK

B. Furnish and install fiberglass reinforced plastic (FRP) duct, dampers and all appurtenances, complete and in place, all in accordance with the requirements of the Drawings.

1.07 RELATED WORK SPECIFIED ELSEWHERE

B. Section 233100 – HVAC DUCT

C. Section 230593 - Testing, Adjusting, and Balancing

1.08 REFERENCED SPECIFICATIONS, CODES, AND STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section entitled “Reference Standards.”

B. Commercial Standards

1. ASTM D 3567 Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber Reinforced-Thermosetting-Resin) Pipe and Fittings.

2. ASTM C 582 Standard Specification for Contact - Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion -Resistant Equipment.

3. AWWA M-45 American Water Works Manual of Water Supply Practices "Fiberglass Pipe Design"

4. 4. ASTM D 3982 “Standard Specification for Contact Molded “Fiberglass” Duct and Hoods” or NBS PS 15-69 “Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment”

5. ASTM D 2992 “Standard Practice for Obtaining Hydrostatic Design Basis for Fiberglass Pipe and Fittings”

6. ASTM D 2310 “Standard Classification for Machine-Made “Fiberglass” Pipe

1.09 SUBMITTALS

F. Shop Drawings

1. The CONTRACTOR shall submit Shop Drawings in accordance with the requirements of Division 1.

2. Fabrication drawings shall have details on Laminate Sequence used.

G. Additional Submittal Information

1. The CONTRACTOR shall submit a copy of this specification with check-marks by each line to show full compliance or a note with attached supporting information noting any deviation for Engineer review.

2. A letter from the resin supplier stating that the material used for this project complies with the specification and meet all corrosion requirements.

3. Design calculations performed by the manufacturer and stamped by a Professional Engineer registered in the State of Georgia for record purposes.

4. Duct manufacturer shall submit certified test results in accordance with ASTM 2992. Engineer will confirm that supplier has completed ASTM 2992 testing.

5. Duct manufacturer shall submit sample coupons of proposed ductwork to ENGINEER which shall be representative of the ductwork (construction method and material used) to be supplied on this project.

PART 2 – PRODUCTS

2.01 GENERAL

A. Manufacturer: Provide FRP duct as manufactured by one of the following w/o exception. All equipment (Duct, dampers, and fittings) shall be the product of a single manufacturer. Out-sourcing of fabrication or parts of the system will not be accepted.

1. Belco Manufacturing

2. Augusta Fiberglass

3. Industrial Plastics Systems

4. NOV Fiberglass Systems

B. Service conditions:

1. All equipment shall be designed for a minimum working pressure of 5.0" w.c. positive and -20.0” w.c. negative pressure. Buried duct shall be designed per AWWA M-45 Standards and be rated for H-20 Loading. The minimum wall thickness for all FRP duct shall conform to the following:

a. Wall thickness for internal positive pressure should be determined by ASTM 22310 using duct manufacturers Certified ASTM 2992 HDB test results. A full copy of the HDB testing should be submitted with the wall thickness calculations.

b. Duct Inside Diameter (inches)

Duct Inside Diameter (inches)	Minimum Wall Thickness (inches)
3 - 16	0.1875
18 - 24	0.220
30 - 36	0.250
42 – 54	0.375

2. The fiberglass reinforced plastic (FRP) ductwork shall be designed and fabricated for odor control service to carry warm, moisture-laden air with hydrogen sulfide, mercaptans and other organic and inorganic compounds typically associated with wastewater treatment.

2.02 DUCT CONSTRUCTION

A. Materials

1. Resin:

   a. Resin shall be premium corrosion resistant vinyl ester resin. Where duct is installed indoors, it shall be fire retardant brominated vinyl ester. Resin shall not contain pigments, dyes, colorants or fillers. Indoor duct should have a Class 1 flame spread rating of 25 or less.

   b. Thixotropic agents may be added to control resin viscosity per resin manufacturer's recommendation.

   c. Acceptable resins shall be:

      1) AOC Vipel K022

      2) Ashland Chemical Hetron FR992

      3) Interplastics CoRezyn 8442.

2. Reinforcement:

   a. Surfacing veil shall be C glass veil with a silane finish and a styrene soluble binder.

   b. Chopped strand mat shall be Type E glass minimum 1-1/2 ounces per square foot with silane finish and styrene soluble binder.

   c. Continuous roving for chopper gun spray up shall be Type E glass.

   d. Woven roving shall be Type E glass minimum 24 ounces per square yard with a five by four weave.

   e. Continuous roving for filament winding shall be Type E glass with a silane finish.

B. Construction:

1. All FRP ductwork shall be of filament wound construction for sizes >10" diameter and hand lay-up or filament wound construction for 10" and smaller. Cast pipe with no reinforced internal corrosion barrier or press molded fittings will not be accepted.

2. Maximum allowable deflection for any size ductwork shall be ½ inch between supports and for any size of duct under worse case operating conditions.

3. FRP ductwork shall be designed using a safety factor of 10 to 1 for pressure and 5 to 1 for vacuum without exception.

4. Out-of-roundness of duct shall be limited to 1% of the diameter.

5. Length of all flanged duct sections shall not vary more than ± 1/2 inch at 70 F.

6. All un-flanged duct shall be square on the ends in relation to the center axis within ± 1/8 inch up to and including 24-inch diameter and within ± 3/16 inch for all diameters greater than 24-inch.

7. Laminates:

   a. All ductwork shall have a resin-rich inner surface, an interior corrosion barrier, an interior structural layer and an exterior corrosion layer and UV resistant coating.

   b. Inner surface: Nominal 10 mils thick composed of a single ply of the C glass surfacing veil embedded in a resin-rich surface. Resin content shall be 90%.

   c. Interior layer: Nominal 90 mils thick composed of at least two layers of chopped strand mat or equivalent chopped strand. Resin content shall be 75%.

d. Structural layer: Type E glass to meet minimum wall thickness as specified. The total wall thickness includes the inner surface.

1) Contact molded structural layer shall include alternate layers of chopped strand mat and woven roving.

2) Filament wound structural layer shall be preceded by a layer of chopped strand mat or spray chop. The structural layer shall consist of a minimum of two complete cross hatched layers of continuous filaments applied in a helix angle of 55 to 65 degrees for above-ground ductwork and 75 deg. for any buried ductwork.

e. Exterior corrosion layer: Single A or C Veil shall be applied to all duct exterior

f. Exterior UV resistant coating: Factory applied paraffinated gel coat with UV inhibitors. Color shall be determined by the ENGINEER.

C. Fittings:

1. All fittings shall be hand lay-up construction fabricated from the same resin and have the same strength as hand lay-up FRP ductwork.

2. The internal diameter of all fittings shall be equal to the adjacent duct.

3. The tolerance on angles of all fittings shall be ±1 degree up to and including 24 inch diameter and ± 1/2 degree for 30 inch diameter and above.

4. Elbows:

a. The centerline radius of all elbows shall be 1-1/2 times the diameter.

b. Elbows 24-inch diameter and smaller shall be smooth radius. Elbows 30-inch and larger shall be mitered. Provide a minimum of two mitered joints (3-piece) for all elbows above 45 degrees.

5. Flanges:

a. Provide flanged connections to flexible connectors, expansion joints, vessels, demisters, fans, silencers and other locations as shown on the Drawings.

b. Flanges shall be hand lay-up construction. Dimensions shall be in accordance with ASTM D 3982, Table 1, and the Duct Dimension Schedule.

c. Flanges shall be drilled in accordance with ASTM D 3982, Table 1. Backs of flange face shall be flat so that washer seats fully on bolt face and flange backing.

d. Flange tolerances shall be in ASTM D 3982, Section 8, Tolerances.

e. Gaskets shall be EPDM, full face and minimum 1/8 inch thickness.

f. All bolts, nuts and washers shall be Type 316 stainless steel.

D. Joints:

1. Provide all butt and strap joints in accordance with ASTM D 3982, Table 2, and manufacturer's drawings.

2. Field weld kits shall be supplied by the duct manufacturer. All necessary fiberglass and reinforcing material shall be supplied pre-cut and individually packaged for each joint. Bulk Glass rolls will not be acceptable.

3. All resin, catalyst and putty shall be supplied in quantities to complete all field joints plus 20% extra for waste.

2.03 EXPANSION JOINTS

A. Furnish duct expansion joints as shown on the Drawings and as required to avoid buckling or compression of duct or displacement of equipment.

B. Expansion joints shall be flanged where connecting ductwork to equipment; otherwise, slip-type will be acceptable.

C. Expansion joints shall be resistant to ultraviolet light with integral flanges and suitable for outdoor service with FRP duct where applicable. Expansion joints shall be as follows:

1. Elastomer material: Fiberglass Reinforced EPDM, minimum 1/8” thickness, rated for 300 degrees F continuous temperature. Device shall be rated for a pressure/vacuum of +/- 40” w.c.
2. Connection Type: Flanged U-Style.
3. Connection Accessories:
   a. Backing rings: Type A-36 CS, 2” x 3/8” thick, Prime Painted
   b. Minimum ½” diameter connection bolting by installing Contractor or Duct Supplier.
4. Nominal Duct Diameter: As shown on the Drawings.
5. Extension: 1/2-inch.
6. Compression: 1-inch.
7. Lateral offset: 1/2-inch.
8. Bolt circle configuration: To match FRP duct flange.

D. Expansion joints shall be equal to Frenzelit North America, Lexington, NC

2.04 BUTTERFLY DAMPERS

A. Round Fiberglass Reinforced Plastic Dampers

1. All round FRP dampers shall be the butterfly type. FRP fabrication shall meet the corrosion requirements specified in this Section for FRP duct work.
2. Leakage shall not exceed 3 cfm/sq. ft at 10” W.C. and 5.25 cfm/sq. ft at 30” W.C. for service as an isolation damper. Unless otherwise specified on the drawings, all dampers are assumed to serve in isolation service.
3. Fabrication:
   a. Frame and blade: premium vinyl ester. Blade shall fully encapsulate shaft. Blades that bolt to a single side of the shaft will not be accepted.
   b. Shaft: Type 316 stainless steel for all dampers.
   c. Bearings and bushings: Teflon.
   d. Pins and all hardware: Type 316 stainless steel.
   e. Shaft seals: EPDM.
   f. Provide all round isolation dampers with a blade stop consisting of FRP angles with full circumference EPDM seals.

g. All dampers shall have flanged ends. Contractor to provide connecting bolts, nuts and washers.

h. All dampers 24" or larger shall be provided with Gear Operators with a epoxy coating. Dampers below 24" shall be supplied with hand quadrant actuators fabricated of Type 316 stainless steel with a 5-stage locking quadrant indicator. All balancing dampers shall have a fully adjustable slot with an extra hole drilled in the handle for contractor to "drill and pin-in place" once system is balanced so handle can not vibrate loose. Drawing may indicate motorized actuators; if so that shall take precedence. Any dampers over six feet above finished floor or operating level shall be furnished with chain wheel gear operators.

i. FRP dampers shall be manufactured by Swartwout, Division of Phillips Industries, Belco Manufacturing, or Ershigs.

j. All Isolation dampers provided shall bear the AMCA seal. Dampers shall be tested in an AMCA laboratory for performance (pressure drop) and leakage.

k. Dampers may be tested after installation to confirm compliance**.**

B. Manual Operators

1. Provide corrosion resistant operators by valve manufacturer.

2. Manual operators shall be gear driven handwheel or chain wheel.

3. Valves installed over five feet above finished floor shall have chain wheel operators.

2.05 DUCT HANGERS AND SUPPORTS

B. All duct supports, interior and exterior, shall meet the requirements of the Section titled “Pipe Supports”, except that hangers and supports for fiberglass duct shall be located at maximum spans as shown in ASTM D 3982, Table 1.

C. Duct supports located on the exterior of the building shall be designed to include the weight of the duct and to withstand all applicable combinations of wind and seismic loading in accordance with the 2006 Building Code. Exterior supports shall be located as shown on the Drawings and shall be of the "saddle type" support as per the standard detail shown on the Drawings. The locations of duct supports shown on the Drawings are approximate, and the CONTRACTOR shall be required to confirm the support requirements and locations.

D. The Contractor shall note that not all duct support locations are shown on the Drawings, and the Contractor shall follow the Specifications herein in locating additional supports as required. The Contractor shall be responsible for the design of additional supports and for the overall stability of the entire support system. Support and hanger details and a detailed layout showing the location of all duct supports and hangers shall be submitted in the shop drawings.

PART 3 – EXECUTION

3.03 INSTALLATION

C. General: All FRP ducts shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the site to avoid interferences with structural members, architectural features, openings and equipment. Exposed ducts shall afford maximum headroom and access to equipment, and where necessary, all ducting shall be installed with sufficient slopes for drainage of liquids and condensate to low points. All installations shall be acceptable to the

ENGINEER. CONTRACTOR shall obtain training by the duct manufacturer's field representative in the correct installation and support of all FRP ductwork.

D. Supports and Anchors: All ducting shall be firmly supported with fabricated or commercial hangers or supports in accordance with the requirements in the Section titled "Pipe Supports". Where necessary to avoid stress on equipment or structural members, the ducts shall be anchored or harnessed. Expansion joints and guides shall compensate for duct expansion due to temperature differences.

3.04 DUCT PREPARATION

A. Prior to installation, each duct length and all fittings shall be carefully inspected, flushed clean of any debris or dust, and straightened, if not true. All duct and fittings shall be equally cleaned before assembly.

3.05 DUCT JOINTS

A. Butt and Wrap Joints: Prior to joining, ends shall be ground smooth. All dust and debris must be fully removed. Ends shall be resin-coated to prevent corrosion, in duct 24" diameter and above an interior corrosion wrap is required. The joint should be of equal strength as the duct. A butt and wrap sequence and thickness chart should be shown on the fabrication drawings. The laminate sequence for each size duct should be supported by a separate section in the design calculations.

B. Supports and Anchors: All duct shall be firmly supported with fabricated or commercial hangers or supports in accordance with the requirements in the Section titled "Pipe Supports". Where necessary to avoid stress on equipment or structural members, the pipes shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature differences.

3.06 INSPECTION

B. Inspection: All finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interference, and damage to pipe, fittings, and coating. Damage shall be repaired to the satisfaction of the ENGINEER.

C. Air Leakage

1. Conduct tests in presence of ENGINEER, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days advance notice for testing.

2. Determine leakage from entire system or section of system by relating leakage to surface area of test section.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 6 for pressure classifications from 2- to 12-inch wg.

4. Remake leaking joints and retest until leakage is less than maximum allowable.

5. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

D. Damper Installation

1. Install dampers in accordance with manufacturer's recommendations.

2. All dampers and appurtenances shall be installed in the locations shown on the Drawings, true to alignment and properly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.
3. Install dampers between duct flanges with 316 stainless steel bolts, nuts and washers.
4. Support duct at both sides of each damper in a manner that allows removal of dampers for maintenance without temporary duct support.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct access doors.
2. Volume control dampers.
3. Flexible duct connections.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
1. UL 555 - Standard for Safety for Fire Dampers.

1.3 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.

B. Product Data: Submit data for shop fabricated assemblies and hardware used.

C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
1. Flexible duct connections.
2. Volume control dampers.
3. Duct access doors.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

A. Furnish one year manufacturer warranty for duct accessories.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS

A. Manufacturers:
   1. Equal to Ruskin

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
   1. Less than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches [with outside and inside handles].
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.

2.2 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Equal to Ruskin.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

D. Quadrants:
1. Furnish locking, indicating quadrant regulators on single blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.3 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Equal to Hart & Cooley.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Connector: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
2. Net Fabric Width: Approximately 3inches wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ducts and equipment installations are ready for accessories.

B. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access and as indicated on Drawings. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Centrifugal square inline fans.

B. Related Sections:
1. Section 23 09 00 - Instrumentation and Control for HVAC: For control dampers and motor actuators.

1.2 SUBMITTALS

A. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA Publication 211

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of experience.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Furnish one year manufacturer's warranty for fans.

PART 2 PRODUCTS

2.1 CENTRIFUGAL SQUARE INLINE FANS

A. Manufacturers:
   1. Equal to Greenheck.
      a. Product Description: Direct drive with galvanized steel housing lined with 1/2 inch acoustic insulation, integral inlet cone, inlet and outlet duct collar, gravity backdraft damper in discharge. Fan wheel shall be forward inclined centrifugal type. For fans arranged for 2-speed operation, fan motor shall be variable speed, electronically commutated.

B. Accessories:
   1. Field adjustable, two-speed controllers for precise control of air flow as scheduled on the Drawings
   2. Motorized volume control dampers for service on the supply fans. See Section 23 09 00 - Instrumentation and Control for HVAC.
   3. Aluminum exhaust hoods with integral bird screens and curb caps

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect area for installation and verify clearances for proper installation and service access.

3.2 INSTALLATION

A. Secure curb cap with stainless steel lag screws to roof curb.

B. Suspended Fans: Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install backdraft dampers on discharge of exhaust fans as indicated on Drawings.

3.3 CLEANING

A. Vacuum clean inside of fan cabinet.

3.4 PROTECTION OF FINISHED WORK

A. Do not operate fans until ductwork is clean, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Registers.
   2. Grilles
   3. Louvers

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Test and rate louver performance in accordance with AMCA 500.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 WARRANTY

A. Furnish one year manufacturer warranty for air outlets and inlets.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:
   1. Equal to Titus.

B. Type: Square, adjustable pattern, stamped, multi-louvered diffuser to discharge air in four-way pattern with sector baffles where indicated.

C. Frame: Inverted T-bar type.

D. Fabrication: Steel with white finish.

2.2 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:

B. Equal to Titus.

C. Type: Fixed grilles of 1/2 x 1/2 x 1/2 core.

D. Fabrication: Aluminum with white finish.

E. Frame: Channel lay-in frame for suspended grid ceilings.

2.3 LOUVERS

A. Manufacturers:
   1. Construction Specialties Inc.
   2. Greenheck Corp.
   3. Industrial Louvers Inc.
   4. Ruskin Manufacturing

B. Product Description: Stationary, drainable blade

C. Type: 6 - inches deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame.

D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory anodized finish in dark bronze.

E. Mounting: Furnish with masonry strap anchors for installation.

F. Bird Screen: Bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

G. Insect Screen: Aluminum mesh, set in aluminum frame.

PART 3 EXECUTION

3.1 GENERAL

A. Manufacturing, shipment, storage, handling and installation of equipment shall be in strict accordance with applicable standards and the manufacturer's printed instructions.

B. The Contractor shall be responsible for the equipment's condition until the completion of the work. Damage or loss of equipment and materials shall be repaired or replaced at the Contractor's sole expense.

3.2 SHIPPING, HANDLING, STORAGE, PROTECTION REQUIREMENTS

A. The equipment provided under this section shall be shipped, handled, stored, and protected in accordance with the manufacturers' written instructions and in accordance with the GENERAL REQUIREMENTS.

3.3 MATERIALS AND EQUIPMENT.

A. All assembled parts and components ready for shipment shall be securely bundled, coiled, or crated and adequately protected from damage and corrosion during shipment and storage.

B. All parts and components shall be factory-assembled in sections convenient for field handling and installation but requiring the minimum amount of work for field assembly. Any field assembly work shall be bolted. No cutting or welding should be required on either field assembly or erection.

3.4 INSTALLATION

A. The system components specified herein shall be installed in accordance with the supplier's written installation instructions, as approved by the Engineer. Location of system components and interconnections between system components and other plant systems shall be in accordance with the Drawings and Specifications.

B. Contractor shall install items in accordance with manufacturer's printed instructions and as indicated and specified.

C. Contractor shall install unit on equipment pad and/or curb as noted on the Drawings and make final alignments thereon.

D. Contractor shall install accessories in accordance with manufacturer's written instruction.

E. Contractor shall prove the unit’s inlet and discharge connections are non-leaking and that connecting duct is supported independently from unit.

END OF SECTION

SECTION 237880
PACKAGED CARBON ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. The work specified herein shall include designing, furnishing and installing all equipment and materials necessary to provide the Owner with a completely operational Odor Control System. The system shall be a packaged FRP carbon adsorption scrubbing system of unitary construction. The Contractor shall be responsible for providing a complete Odor Control System which shall include, but not limited to FRP scrubbers, mist eliminator, carbon media, control system, exhaust blower, ducting, dampers and all necessary accessories.

B. The CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS contain information and mandatory requirements for work specified herein.

1.02 DESCRIPTION

A. Packaged Carbon Scrubbers: SCR-101, 201, 301 & 401

B. The Supplier shall furnish and install a complete, pre-piped, wired, and packaged unitary construction odor control system including an integral adsorber with a mist eliminator, exhaust fan, fittings and all other equipment and accessories as specified to provide a complete and functioning system.

1.03 REFERENCE STANDARDS

A. PS 15-69: National Bureau of standards Voluntary Product Standard "Custom contact molded Reinforced Polyester Chemical Resistant Process Equipment".

B. ASTM D-883: "Definition of Terms Relating to Plastics"

C. ASTM D-2583: "Test for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor."

D. ASTM D-2563: "Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts."

E. ASTM D-4097-01: "Standard Specifications for Contact Molded Glass Fiber Reinforced Thermoset Resin Chemical Resistant Tanks."

1.04 QUALITY ASSURANCE

A. Inspection and Testing Requirements: The Engineer reserves the right to reject delivery of any or all pieces of equipment found, upon inspection, to have any or all of the following: blisters, chips, crazing, exposed glass, cracks burned areas, dry spots, foreign matter, surface porosity, sharp discontinuity or entrapped air at the surface of the laminate. Any item which does not satisfy the tolerances as below shall be rejected:

Defect	Inside Surface	Outside Surface
Blister	None	Max. dimensions: 1/4” diameter by 1/8” high; Max density: 1 per sq. ft.; Min. separation: 2” apart
Chips	None	Max. dimension of break: 1/4" and thickness no greater than 10% of wall thickness; Max. density: 1 per sq. ft.
Crazing	None	Max. length: 1/2"; Max. density: 5 per sq. ft.; Min. separation: 2”
Cracks	None	None
Exposed Glass	None	None
Scratches	None	Max. length: 1”; Max. depth: 0.010”
Burned Areas	None	None
Surface Porosity	None	None
Foreign Matter	None	None
Sharp Discontinuity	None	None
Pits	Max. 1/8 inches, dia. by 1/32 inches deep; Max: 10 per ft^2	Max. 1/8” dia. by 1/16” deep; Max: 10 per sq. ft.
Dry Spot	None	2 sq. in. per sq. ft.
Entrapped Air	None at the surface 1/16 inches and 10 per square in. max	1/8” and 4 per sq. in. or 1/16” and 10 per sq. in. within laminate

B. The Engineer reserves the right to be present at the fabricators facility for visual inspection of equipment to be supplied.

C. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation without excessive noise, vibration, overheating, etc. Compliance shall be based on the equipment manufacturer's specifications and all applicable costs to meet those standards shall be borne by the contractor. All equipment must be adjusted and checked for misalignment, clearances, supports, and adherence to safety standards.

D. The Contractor shall be responsible for the successful startup and testing of each odor control system. The Contractor shall provide all necessary facilities, manpower, chemicals, tools, instrumentation, and laboratory testing services required during this phase of the work.

1.05 SUBMITTALS

A. The Contractor shall submit complete scrubber system drawings, together with all piping, ductwork, valves, and controls for review by the Engineer. Submittals shall be made in accordance with Section Contractor SUBMITTALS in Division 1, GENERAL REQUIREMENTS.

B. Drawings: The Contractor shall submit the following information for approval before equipment is fabricated:

1. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all

equipment and sufficient information to allow the ENGINEER to check clearances, connections, and conformance with the specifications.

2. Materials of construction of all equipment.

3. Manufacturer's catalog data, operating literature, specifications, performance and calibration curves for chemical recycle pumps, exhaust fan, and auxiliary components.

4. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and electrical components.

5. Manuals: Furnish manufacturer's installation recommendations, bulletins, and spare parts lists.

6. Certification documentation and qualifications for independent testing agency for odor control media.

C. Prior to shipment of each vessel, submit four copies of a report, including certification, that the quality control, testing, and inspection have been completed and that the standards specified herein have been met for the vessel.

1. Complete process calculations showing calculated values for odor reduction performance. Calculations shall include assumed values for ambient conditions, safety factors used, and other assumptions.

2. Complete narrative including a description of the process, functional description and physical characteristics of the system components, and process performance parameters. Include a discussion of maintenance requirements and system limitations.

3. Instructions for shipment, storage, handling, and installation of the system and its components.

4. Written performance guarantee for service conditions and removal rates specified herein.

1.06 MANUFACTURER'S SERVICES

A. A factory engineer or technician shall be present at the job site for two days; travel time excluded.

1. Day One: Four (4) hours for inspection and certification of the installation.

2. Day Two: Eight (8) hours to carryout performance testing and to train Owner's staff in operation of the system.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide the odor control system as specified to treat in a single pass the odorous air from the contaminated areas. The system shall be designed for continuous and automatic operation. The scrubber system shall be designed to withstand a temperature up to 150°F. The multi-stage packaged FRP system shall be of unitary construction as specified below.

B. Acceptable Manufacturers: Purafil, Atlanta, GA; Siemens, San Diego, CA; PureAir, Atlanta, GA; and ECS, Belton, TX.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Design and Performance Criteria:

1. Criteria: Foul air removed from each facility will have average and peak concentrations of hydrogen sulfide (H_2S) and reduced sulfur compounds and design air flow rates as listed in the following table:

System I.D.	Air Flow Rate (CFM)	Avg H_2S Conc. (PPMv)	Peak H_2S Conc. (PPMv)	Avg Reduced Sulfur Compounds (PPMv)	Peak Reduced Sulfur Compounds (PPMv
SCR-101	850	2.6	5.1	0.25	0.50
SCR-201	850	2.6	5.1	0.25	0.50
SCR-301	850	2.6	5.1	0.25	0.50
SCR-401	850	2.6	5.1	0.25	0.50

2. System Performance: The odor control system shall demonstrate a removal efficiency of 99.5% for all listed contaminants. Reduced sulfur compounds include carbon disulfide, dimethyl sulfide, mercaptans and carbonyl sulfide.

2.03 CHEMICAL MEDIA

A. All media shall consist of manufactured, generally spherical porous pellets. The pellets shall be formed from combinations of powdered activated carbon, alumina and other binders suitably impregnated with chemical additives to enhance the capacity for removal of odorous gases. Coconut shell carbon shall not be permitted. The pellets shall chemically react to produce solid reaction products within the media. Impregnants shall be applied during pellet formation such that the impregnant is uniformly distributed throughout the pellet volume. Media shall be capable of absorbing and removing odorous gases throughout the entire pellet.

B. The media used in the scrubber shall have a two-part composition to capture hydrogen sulfide and reduced sulfur compounds in the concentrations as noted above. The media combinations used must be shown to have a life of at least five (5) years at the contaminant concentration levels noted in the performance criteria.

1. PART A (for hydrogen sulfide removal): This composition shall be designed primarily for the removal of H2S odors and shall consist of porous, high grade bituminous activated carbon. This media shall be a high capacity media with the following physical properties:

a. H2S Removal Capacity (by volume): 0.30 g/cc min

b. Removal Capacity (by weight): H2S: 50% min

c. CTC value: 70% min

d. Surface Area: 1050 m2/g min

e. Typical Apparent Density: .44 g/cc (28 lbs/ft3)

f. Moisture Content: 15% max

g. Hardness: 95 min

h. Ignition Temperature: >400 C

i. Iodine No.: 1050 mg/g min

j. Butane Activity, (weight%): 26% min

k. Mean Particle Diameter: 4 mm (typical)

2. PART B (for reduced sulfur compound removal): Media shall be designed for the removal of reduced sulfur compounds and act as a polishing agent. Media shall have the following physical properties:

a. General Description: Spherical or cylindrical porous pellets formed from a combination of powdered activated alumina and other binders, suitably impregnated with potassium permanganate to provide optimum adsorption, absorption, and oxidation of a wide variety of gaseous contaminants.

b. Media shall be a high capacity material with the following removal capacities:

1) Hydrogen Sulfide: 0.19 g/cc min (23% by weight)

2) Sulfur Dioxide: 0.10 g/cc min (11% by weight)

3) Nitric Oxide: 0.06 g/cc min (7.5% by weight)

4) Nitrogen Dioxide: 0.024 g/cc min (3.0% by weight)

5) Formaldehyde: 0.04 g/cc min (4.5% by weight)

3. Manufacturing Quality Assurance Standards:

a. Leach Test (indication of porosity)- 180 minute or less

b. Permanganate Content: 12 % minimum

c. Moisture Content: 20 % maximum

d. Crush Strength: 40 to 60 %

e. Abrasion Loss: 3.0 % maximum

f. Nominal Pellet Diameter: 1/8” (approximately 4 mm), 85% after screening

g. Nominal Density: 50 lbs/ft3 (0.80 g/cc)

h. UL Rating: Media shall meet the requirements of a UL Class 1 fire rating.

C. Media Remaining Life Testing: Manufacturer shall provide free quarterly media testing for the life of the media installation to provide critical data including remaining permanganate content, total life prediction, moisture content, and projected replacement date. Data is provided for each of the separated components of a blend. All analyses are to be performed at an independent certified laboratory recommended by the manufacturer and approved by the Engineer.

2.04 SCRUBBER VESSEL

A. Materials of Construction:

1. The scrubber absorber vessel and accessories shall be contact molded manufactured in accordance with NBS PS 15-69, ASTM D 4097 for contact molding. Any visual defects shall not exceed the tolerances specified in the table located in section 1.04, item B. Any material of construction other than FRP with premium grade vinyl ester resin will not be allowed.

2. Resin used in fabrication shall be a premium vinyl ester type such as Hetron 922 by Ashland Chemicals, Derakane 411 by Dow Chemical or approved equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010.

3. Reinforcement: Glass fiber reinforcement used shall be commercial grade corrosion resistance borosilicate glass.

   a. All glass fiber reinforcement shall be Type C chemical grade, Type E electrical grade.

   b. Surfacing veil shall be 10 mil Nexus 111-00010 or equal.

   c. Mat shall be Type "E" (electrical grade) glass, 1 1/2 oz. per sq. ft with a nominal fiber length of 1.25 $\pm$ 0.25 inches, with a silane finish and styrene soluble binder.

   d. Continuous glass roving, used in chopper gun spray-up applications shall be type "E" grade with chrome or silane coupling agent.

   e. Woven roving used for reinforcement shall be 24 oz. per sq. yard type "E" glass and have a 5 x 4 plain weave.

4. Miscellaneous:

   a. Stainless Steel: Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets etc shall be ANSI 316SS.

   b. Gaskets: Unless otherwise specified, all gaskets shall be EPDM.

B. Fabrication:

1. General: Fabrication shall be in accordance with NBS PS 15-69 and ASTM D-4097. All non molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat. All voids to be filled with a resin paste.

2. Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion layer shall consist of two layers of 1 1/2 oz. per sq. ft. chopped strand mat. If the application is by chopper gun spray, the glass fiber shall be 1/2 to 2 in length. The total corrosion liner thickness shall be a minimum of 100 mils and have a resin to glass ratio of 80/20. All edges of reinforcement to be lapped a minimum of one inch.

3. Structural Laminate: Structural laminates shall consist of alternating layers of 1-1/2 oz per sq. ft mat or chopped glass and 24 oz per sq. yard woven roving applied to reach a designed thickness. Actual laminate sequences shall be per the laminate tables shown on fabrication drawings. The exterior surface shall be relatively smooth and shall have no glass fibers exposed. The exterior shall be surface coated with white gel coat containing ultra violet light inhibitors.

C. Accessories: Air inlet, air outlet, blower connection, baffles, media supports, drain, and all connections shown on the drawings shall be provided by the manufacturer. Tie down lugs shall be integrally molded into vessel. Anchor bolts shall be 316SS and designed for the specified loads.

Air connections shall be duct flanges per PS 15-69 Table 2. Interior fasteners shall be of corrosion resistant materials such as PVC or FRP.

D. Mist Eliminators & Grease Filter: Device shall be 99% efficient for capture of water droplets 2 microns and greater. The Mist & Grease Filter shall be constructed of Type 316L stainless steel mesh along with fiberglass mesh in a multi-layer arrangement with minimum 4-inch thickness.

E. Neoprene Pad: A 1/4" thick, 60 durometer neoprene rubber sheet must be placed underneath the scrubber vessel.

F. Silencer: The scrubber system shall include a silencer manufactured of Type 316 stainless steel. Silencer shall provide for a minimum noise reduction of 15 dBA on scrubber outlet. Silencer shall be equal to Lindlab SLGU-04.

2.05 EXHAUST FAN

A. Exhaust Fan: Fan shall have be mounted on the clean air outlet side of the scrubber and shall be an aluminum body, centrifugal, backward inclined impeller. The wheel shall be dynamically balanced. The aluminum alloy in the body of the fan shall be resistant to corrosion by the contaminants levels identified above in the scrubber outlet air stream. The shaft shall be carbon steel and shall have a stainless steel sleeve. The shaft seal shall be Teflon or Viton.

B. Bearings shall be heavy duty, self aligning grease lubricated ball type with minimum of 100,000 hour B-10 life. OSHA approved belt guard and shaft guard shall be provided. Motor shall be high-efficiency, TEFC, 1800 RPM with a 1.15 service factor and suitable for 460-volt, 3-phase service.

C. The fan shall be designed for the following specifications:

FAN PERFORMANCE				
PERFORMANCE CRITERIA	SCR-101	SCR-201	SCR-301	SCR-401
Air Flow Rate (CFM)	850	850	850	850
External Static Pressure (in. w.c.)	1.0	1.0	1.0	1.0
Motor HP	3	3	3	3
Voltage/Phase	460V/3-ph	460V/3-ph	460V/3-ph	460V/3-ph

D. Flexible Connector:

1. Provide flanged expansion joint for outlet of fan to FRP vessel inlet transition piece. The flange drilling shall be coordinated with fan and transition.

2. Type : W-design configuration with integral flanges suitable for service with FRP duct.

3. The properties of the flexible connectors shall be as follows: Material shall be EPDM. Material shall be resistant to ultraviolet light degradation and shall be suitable for contact with odorous air as specified herein. The backing rings shall be 1/4-inch thick, 2” wide, Type 304 stainless steel. The length from flange-to-flange shall be 6” unless shown otherwise. The extension shall be 1 inch, compression shall be 2 inches, lateral offset shall be 2.5 inches and the thickness shall be ¼-inch minimum.

4. Manufacturer shall be Senior Flexonics or approved equal.

E. The motor shall be manufactured by WEG, Baldor, Reliance or approved equal.

2.06 ELECTRICAL CLASSIFICATION

A. The system shall be designed and fabricated in compliance with National Fire and Protection Agency Code 820. As a minimum, all equipment installed on the system shall be rated for Class I, Division 2, Group D service.

B. All motors within three feet of the air stream shall be rated for Class I, Division 2, Group D service

2.07 INSTRUMENTATION AND SYSTEM CONTROLS

A. The electrical control panel shall provide electrical control for the exhaust fan. A single-point power supply with voltage and phase rating as scheduled shall be provided for the scrubbing system. Provide an internal transformer(s) for all other power required for control components and accessories.

B. The control panel enclosure shall be of fiberglass construction and rated NEMA 4X. The panel shall be mounted remotely from the scrubber assembly. The panel shall be factory tested to full operation with all other components prior to shipment.

C. The panel shall be shipped loose and remotely mounted to avoid installation in a classified area.

D. The panel shall have the following components or capabilities:

1. Fan starter
2. Fan control switch (ON-OFF) and indicating lamp.
3. Provide remote run status and fault indication contacts for remote reporting to the facilities control system.

2.08 ACCESSORIES

A. Differential Pressure Gauges: Two magnehelic type pressure gauges shall be provided to monitor pressure drop across the scrubber. Transparent overlays will be included. The manufacturer shall be equal to Dwyer.

PART 3 - EXECUTION

3.01 FIELD WIRING

A. The Contractor shall mount the factory control panel remotely from the scrubber system as shown on the Drawings and wire it to the odor control system. The factory control panel shall be shipped separately. The odor control system will be equipped with one NEMA 7 junction box that shall be factory-mounted to the system for connection of wiring between the factory control panel and the equipment mounted on the odor control system.

3.02 TESTING REQUIREMENTS AND START-UP

A. Test Procedures: The time of the tests and detailed test procedure shall be submitted for approval prior to the testing period. In the event hydrogen sulfide levels are below anticipated levels, the Contractor shall augment hydrogen sulfide levels in the influent airstream so that the hydrogen sulfide concentration is -2 to +10 ppm of the design level.

1. Prior to testing, scrubber air flow rates shall be verified to meet performance criteria and shall be held constant. Changes in scrubber system operating conditions shall not be permitted. All fine-tuning of operating conditions shall be performed prior to testing.

2. Design operating conditions shall be maintained for a minimum of 4 hours. During this time, all pertinent operating parameters shall be monitored and recorded and sufficient sampling and analysis shall be conducted to demonstrate that the air flow rate and removal efficiency are at the design conditions.

3. Hydrogen sulfide concentration shall be measured in each scrubber inlet and outlet. As a minimum, the test shall be conducted for 1 hour at the average H_2S level, 1 hour at the peak H_2S level, and the balance of 2 hours on actual pump station odor conditions. Inlet and outlet levels shall be measured once every 30 minutes using a portable H_2S analyzer such as Interscan or equal.

4. Results: A description of the performance tests shall be submitted. The hydrogen sulfide compound removal efficiency shall be as specified in the design and performance requirements. Should scrubber system performance not meet any of the above requirements, the system shall fail the performance test. The Contractor shall make any additions or modifications to the scrubber system as may be necessary, at no additional cost to the Owner, and the performance test for the system shall be repeated in its entirety.

B. Start-up: The services of a factory representative shall be provided as specified in Section 1.06 to ensure proper installation and start-up of the scrubber system.

3.03 OPERATION AND MAINTENANCE MANUALS

A. Six manuals shall be submitted prior to final acceptance of the equipment.

3.04 WARRANTY

A. Contractor shall warrantee the whole system, both in material and workmanship for a period of one year from the day of beneficial occupancy. This period shall not extend beyond 18 months after delivery of equipment to job site.

END OF SECTION

SECTION 23 82 00

CONVECTION HEATING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Electric duct heaters.
2. Electric unit heaters.

B. Related Sections:
1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
3. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 ELECTRIC DUCT HEATER

A. Manufacturers shall be equal to:
1. Chromalox;
2. Indeeco; or
3. Watlow

B. Assembly: with terminal control box and hinged cover, splice box, coil, casing, and controls.

C. Coil: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings. Provide heating elements to mounting flange with threaded fittings and fiber washers to prevent leakage of ducted air into the terminal housing.

D. Casing: Die formed channel frame of 18 gage galvanized steel with 3/8 inch mounting holes on 6-inch centers. Furnish tube supports for coils longer than 36-inches.

E. Controls: Automatic reset thermal cut-out, SCR power controls for precise control of heater output temperature. Furnish SCR power control panel with NEMA 4 enclosure, control circuit transformer and fuse, air flow proving device and fused disconnect.

2.2 ELECTRIC UNIT HEATERS

A. Manufacturers shall be equal to:
1. Chromalox; or
2. Q-Mark.

B. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

D. Cabinet: 0.0478-inch thick steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct-drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models; ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Furnish thermal overload.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ductwork is ready for installation.

B. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Install duct heaters in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible. Refer to Section 23 31 00.

B. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

END OF SECTION

SECTION 26 00 00
GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install all materials, equipment, labor, supervision and services necessary to complete all electrical work specified herein, and shown on the Drawings.

B. Principal Features

1. Complete system of conduits, cables and conductors to supply electrical energy throughout the facility.

2. Lighting fixtures, ballasts, and lamps.

3. Motor control centers, distribution and lighting panels.

4. Switchboard.

5. Standby generator.

6. Coordination with utility companies for:

a. Incoming electrical service.

b. Incoming telephone service.

7. Electrical Systems Analyses

8. Short circuit study.

9. Protective device coordination study.

10. Arc Fault Study

1.02 APPLICABLE STANDARDS AND CODES

A. National Electrical Code, latest edition.

B. Rules of the Electrical Utility and the National Electrical Safety Code.

C. Life Safety Code 101.

D. NECA Standard of Installation.

E. NFPA (National Fire Protection Association).

1.03 FEES AND TESTS

A. Contractor shall be responsible for all fees for permits, inspections, and tests necessary to complete this work. Contractor shall demonstrate to the Owner and the Engineer that all items of equipment installed are completely operational and free of defects in all modes.

1.04 COORDINATION WITH OTHER TRADES

A. Furnish and locate all anchor bolts, inserts and supports for installation by the other trades as required. Coordinate the location of all fixtures, outlets, equipment, and devices with other trades to avoid conflicts.

1.05 LIST OF PROPOSED MANUFACTURERS

A. List of Proposed Materials: The Contractor shall submit a complete list of the proposed manufacturers for each of the items listed in the following electrical specifications. Additional submittal data, sufficient to determine equality, shall be required if the Contractor proposes to substitute another manufacturer's equipment.

1. Intent of Drawings:

a. Electrical plan drawings show only general locations of equipment, devices and raceways, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the review of the Engineer.

2. Departures from Contract Documents

a. Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such requests as soon as practicable and within 30 days after award of the Contract. Make no such departures without written approval of the Engineer.

PART 2 PRODUCTS

2.01 REFERENCE TO DRAWINGS

A. Reference shall be made to Drawing Schedules, Details, Notes, and Specifications for: Manufacturer, model, catalog number, size, capacity, performance, ratings and installation of equipment and material.

2.02 CHOICE OF MATERIALS AND EQUIPMENT

A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimal and must be equaled, (2) physical size limitations for space allotted, (3) structural properties, (4) noise level, (5) interchangeability, (6) compatibility with other materials and assemblies, (7) similar items shall be same manufacture and style wherever possible.

B. All material and equipment, for which a UL, ANSI, or a NEMA Standard is established, shall be so approved and labeled or stamped.

C. Adhesives are not acceptable as a mounting, supporting, or assembling technique, unless noted otherwise.

2.03 ELECTRICAL EQUIPMENT

A. NEMA Standards shall be taken as minimum requirements for electrical equipment.

B. Equipment shall operate properly under a plus or minus 10 percent voltage variation.

2.04 SUBMITTALS DURING CONSTRUCTION

A. Provide complete manufacturers' descriptive information and shop drawings for all equipment, material and devices furnished under Division 26000, Electrical, including certified outline drawings, arrangement drawings, elementary (schematic) diagrams, interconnection and connection diagrams, in accordance with provisions elsewhere in these Contract Documents. Provide the number of copies specified herein for the Engineer, Contractor and Operation and Maintenance Manuals.

B. Provide certified shop drawings, literature and requested samples showing items proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete review and for use during installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of the schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA ICS 1.

C. Manufacturer's standardized elementary diagrams will not be acceptable unless applicable portions of the diagram have been clearly identified and non-applicable portions deleted or crossed out.

D. The following submittals shall be made in accordance with Division 1, General Requirements.

E. Certified arrangement drawings, outline dimensions, and weights for all major (engineered) equipment including, but not limited to:

1. Low voltage switchgear.

2. Transformers.

3. Motor control centers.

4. Engine – generators.

5. Variable frequency drives.

F. Functional description or logic diagrams for all control systems furnished under Division 260000, Electrical.

G. Characteristic curves for all protective devices.

H. Certified drawings and descriptive literature for all equipment and devices furnished under Division 26, Electrical, and not listed above.

I. Schematic (elementary drawings for any electrical control and bills of material for equipment including, but not limited to:

1. Switchgear

2. Motor control

3. Control systems furnished under Division 26, Electrical.

4. Engine – generator sets.

5. Variable frequency drives.

J. Connection diagrams showing all internal wiring and all required field connections for the following:

1. Low voltage switchboard

2. Low voltage motor control centers

K. The interconnection diagrams shall show terminal points, intermediate connections, device designation, terminal numbers, polarity of dc circuits, conductor identification, and any other information necessary to show which conductor connects to which point; the Contractor shall review and sign off on the control interconnection diagrams.

L. In addition to submittals for specific items mentioned above, furnish shop drawing information on the following items:

1. Low voltage fuses.

2. Panelboards.

3. Separately mounted circuit breakers, fused switches, and nonfused disconnect switches.

4. Conduit, tubing, and fittings.

5. Power conductors.

6. Wireway.

7. Outlet and device boxes.

8. Pull boxes and junction boxes.

9. Terminal junction boxes.

10. Manholes and handholes.

11. 600-volt conductors.

12. Control cable.

13. Lighting fixtures.

14. Emergency lighting units.

15. Ballasts: fluorescent, high-pressure sodium, metail halide.

16. Light poles and luminaires.

17. Receptacles.

18. Light switches.

19. Device plates.

20. Push-button indicating lights, selector switches: devices and station.

21. Control relays and timers.

22. Speed control systems.

23. Dry type small power transformers, 0-600V primary.

24. Telephone systems.

25. Surge suppressors

26. Fiber Optic Cable.

M. Electrical Systems Analyses

1. Obtain a short circuit study of the electrical distribution system. Include all calculations, selected equipment and devices, and recommended settings. The study is to encompass all devices from the utility connection and on-site generator to all motors, disconnects, vfds, control panels, and distribution panel.
2. Obtain an Arc Flash Hazard Analysis Study per the requirements set forth in the latest version of NFPA 70E - Standard for Electrical Safety in the Workplace and shall comply with IEEE 1584. The study shall include all electrical distribution equipment from the service entrance equipment down to and including 480V panelboards.
3. The study preparer shall furnish and install arc flash labels. Labels shall be provided for switchboards, panelboards, industrial control panels, variable frequency drives, meter socket enclosures, motor control centers, disconnect switches, and all other equipment outlined in NFPA 70E - Standard for Electrical Safety in the Workplace. Labels shall be suitable for outdoor installations and be rated for direct sunlight. Labels shall made in accordance with and carry all information as outlined in the latest version of NFPA 70E - Standard for Electrical Safety in the Workplace.
4. The study shall be done using the latest version of ETAP or SKM software. All files associated with the report, including the written report, labels, power study files, etc. shall be submitted on a USB stick and included with the shop drawing submittal.
5. The contractor is responsible for providing field data (conductor materials, nameplate information, etc) to the study preparer. The Contractor is also responsible for providing to the study preparer shop drawing data on new equipment. The study prepare is responsible for obtaining all other needed data.
6. The report shall include:
   a. Tabulations of recommended settings and time current curves showing the degree of coordination obtained with the recommended settings.
   b. Computer Printouts for short circuit calculations and arc flash study.
   c. Copies of all proposed Arc Flash labels
   d. Documented data obtained from utility company and manufacturers
7. Electrical Systems Analysis shall be done by the Engineer of Record (Womack Lumsden & Associates, LLC at 770-458-3005) or Owner approved equal and paid for by the Contractor.

PART 3 EXECUTION

3.01 WIRING ELECTRICALLY OPERATED EQUIPMENT

A. The Contractor shall be responsible for electrical connections to all equipment requiring electrical power. This responsibility applies to equipment furnished under this and other Divisions and by the Owner.

3.02 RECORD AND AS-BUILT DOCUMENTS

A. Maintain at the job site a set of Contract Documents kept current by indicating thereon all changes, revisions and substitutions, between work as specified and as installed.

B. Furnish Owner with complete set of Operation and Maintenance Manuals.

3.03 EQUIPMENT OPERATION

A. This Division is responsible for: (1) proper rotation, (2) observing that lubrication has been properly performed, (3) that motors operate within nameplate limits, and (4) adjustment of circuit breaker and MCP trip settings.

3.04 CLEANING AND PAINTING

A. Fixtures, panels and equipment shall be thoroughly cleaned. All equipment shall be touched up or repainted as required to present a clean professional appearance. Paint all ferrous metal that is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic No. 50.

3.05 IDENTIFICATION

A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters, junction boxes and metering by permanent nameplates, with wording approved by Engineer. Secure metal nameplate frame with screws or brads. Adhesives are acceptable on components within NEMA 1 enclosures.

B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.

C. All conduits shall be identified with a stamped stainless steel tag system (Brady or approved equal). Conduit tags shall be permanently attached to each exposed end of conduit runs such as in manholes, pull boxes, panels, MCC's, junction boxes, etc. and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.

D. Each instrument shall be identified with a stamped stainless steel tag system (Brady or approved equal). Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate number per instrument specification section.

E. Each cable shall be identified with a permanent labeling system (Brady Catalog Number B-292 with printed legends or approved equal). Instrumentation cables shall be labeled with the appropriate instrument number of the originating signal (Ex. FT-2020-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable number per the conduit and cable schedules.

F. All switchgears, MCC's, MCC compartments, power panels, lighting panels, control panels, control cabinets, etc. shall be identified with permanently mounted phenolic labels.

G. All power and lighting panels shall have typed schedules mounted on panel doors.

H. All terminals and associated wires shall be numbered and labeled respectively, and wiring diagrams shall be installed in the MCC or electrical panel doors.

3.06 TEST PERIOD

A. Each piece of equipment shall continue to meet performance specifications throughout the first year of actual operation. Contractor shall replace or repair any defect due to faulty workmanship or material which shall develop within 1 year from date of acceptance. This guaranty shall cover both material and labor.

B. For first year after final acceptance, Contractor shall provide, at no cost to Owner, any required maintenance and service necessary to assure the proper operation of the system. Date of acceptance shall be certified by Engineer as that date on which the contract has been satisfactorily completed in accordance with the Contract Documents.

3.07 GROUNDING

A. See Specification 26 05 26.

3.08 ELECTRICAL TESTING AND START-UP

A. General

1. Prior to energizing any equipment, the electrical contractor shall thoroughly vacuum clean the equipment with an industrial type vacuum cleaner. The outside of all electrical equipment shall be cleaned and paint touched up as required to leave equipment in an “as purchased” condition.

2. During start-up of new equipment, the electrical contractor shall provide sufficient personnel to aid with start-up of the electrical equipment to remove any faults, and to make the necessary adjustment for proper operation of electrical equipment and installation. This includes sufficient personnel to aid equipment service personnel in their check-out of the electrical equipment and service.

3. All testing equipment shall be furnished by the Contractor.

4. All failures under tests due to defective material or poor workmanship shall be corrected by the Contractor at no expense to the Owner.

5. The electrical contractor shall not, under any circumstances, energize any electrical equipment covered by these Specifications without first obtaining permission from the Engineer.

B. Grounding

1. After all connections have been made to the ground, ground tests shall be made to verify its adequacy.

C. Typewritten directories shall be inserted in all panels showing the designation of each circuit. All power and replacement fuses necessary for testing shall be furnished and paid for under this item.

D. Circuit Continuity

1. Complete installation shall be free of short circuits, open circuits, and other defects. Insulation Resistance and Continuity Tests shall be performed in accordance with Section 26 05 19 to prove that all parts of the installation are intact.

3.09 INSTALLATION OF EQUIPMENT

A. The electrical contractor shall coordinate with the Contractor and Owner in order to have electric power available when required.

3.10 TEMPORARY ELECTRIC POWER

A. Refer to General Conditions in these Contract Documents for necessary provisions for electric power used during construction.

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide all labor, equipment and materials required to complete the installation specified herein, and shown or scheduled on the Drawings. Since the drawings are schematic, all fittings, connectors, etc. are not shown, but shall be furnished as required for a complete functional installation.

1.02 QUALITY ASSURANCE

A. Where not otherwise specified, all material and methods shall be of the highest industrial quality suitable for the application. All panelboards, motor starters, transformers, and other electrical equipment that is stored prior to installation, or that is installed outdoors, shall be protected from corrosion and rust with a product equal to Zerust Vapor Capsules or Cutler-Hammer Oxidation Inhibitor Capsules.

1.03 SHOP DRAWINGS

A. Shop Drawings are required for the following items: Safety Switches, Motor Control Centers, Wire, Manholes, Handholes and Covers, Starters, Circuit Breakers, Lighting Fixtures and Poles. A list of product manufacturers is required for all other items covered by these Specifications.

PART 2 PRODUCTS

2.01 HAZARDOUS AREAS

A. Provide devices, materials, and equipment for installation in hazardous areas that are specifically approved for installation in hazardous areas of the Class, Division and Group indicated, and are of construction that will ensure safe performance under conditions of proper use and maintenance. Provide devices, materials, and equipment meeting the requirements of the 2008 NEC with 2009 Georgia Amendments, applicable state and local codes, and the authority enforcing these codes. Acceptable manufacturers: Crouse Hinds, or Appleton.

2.02 MATERIALS

A. Conduits

1. See section entitled “Conduits” of these Specifications.

B. Wires and Cables

1. See section entitled “Wire and Cable” of these Specifications.

C. Outlet Boxes and Covers

1. Outlet Boxes: Raco, Steel City, or equal.

2. Outlet Box Covers:

a. Switch: Sierra Cat. No. S-1N, S-2N, etc.; Hubbell 93071, or equal.

b. Weatherproof Covers: Sierra Cat. No. WPD-8, or equal.

D. Switches

1. Heavy-Duty, AC quiet, premium, specification grade, toggle type. UL Test UL 20. 120/277 volts AC, 20 amps; gray toggle. General Electric, Hubbell, or equal. Provide watertight switches in NEMA 4X enclosures for wet areas.

E. Receptacles

1. Two-pole, 3-wire, straight blade, heavy-duty grounding. UL Test UL 498. 125 volts AC, 20 amps, gray urea face. Bryant, Leviton, or equal.

2. Provide special purpose receptacles where shown. Coordinate ampere rating and receptacle configuration with power feeder circuit and equipment to be served.

F. Device Plates

1. Satin finished, Type 430 Stainless Steel - ganged as required for non-air conditioned areas. Impact resistant lexan (Brown, Gray or Ivory as necessary to match wall finish) for other interior areas.

G. Safety Switches

1. Furnish and install fusible and non-fusible, 3-pole, heavy-duty, safety switches where shown on the Drawings. All safety switches shall be NEMA Heavy Duty Type TH and Underwriter's Laboratories listed. All switches shall be of dead front construction with blades fully visible when in the "OFF" position with the door open. Mechanism shall be quick-make, quick-break with provisions for up to 3 padlocks in the OFF position. All exterior switches shall be of code gauge (UL98), stainless steel, NEMA 4X, or foamed thermoplastic NEMA 4X. Enclosures shall be Carlon, Hoffman or equal, or as furnished by the electrical equipment manufacturer. Safety switches shall be equal. General Electric, Cutler-Hammer, Square D or equal.

H. Panelboards

1. General

a. Furnish panelboards as described herein and with protective devices of the required number, rating and type as shown on plans. Panelboards shall be listed and labeled by Underwriter's Laboratories under requirements of UL 67 and UL 50. Panel shall bear UL short circuit rating level in addition to the UL panel label. Panels shall meet NEMA PBI, and shall comply with NEC code. Circuit-breakers shall be bolt-in type. Plug-in breakers or "load-center" type construction is not acceptable. Panels shall be Square D, GE, Cutler-Hammer or equal. Panels shall have pole spaces as shown on the drawings.

2. Electrical Rating

a. Panels rated for 120/208 volts shall be 3-phase, 4-wire, solid neutral, 60 Hz and 22,000 A.I.C. Panels rated for 277/480 volts shall be 3-phase, 4-wire, sold neutral, 60 Hertz rated for 42,000 amps RMS symmetrical.

3. Boxes and Fronts

a. Boxes shall be galvanized code gauge steel, minimum of 4 inches of wiring gutters at all points. Fronts, complete with trim clamps, shall be of code gauge sheet steel, painted light grey over a rust inhibitor and shall be equipped with door, hinges, cylinder lock and directory card. All locks shall be keyed alike. After installation, directory card shall be typed with circuit designations corresponding to circuit breaker numbering.

4. Interiors

   a. Complete factory assembled interiors shall consist of a reinforced galvanized sheet steel frame with bus bars and circuit breakers properly supported to prevent vibration, breakage in handling, and to withstand the indicated short circuit currents. All terminals shall be solderless type suitable for copper or aluminum cable of sizes indicated. Bus bars shall be tin-plated copper and sequence phased. Neutral bar, when required shall be located on the opposite end of the panel from mains, and shall be insulated.

5. Circuit Breakers

   a. Circuit breakers shall be fully interchangeable without disturbing adjacent units. Breakers shall be quick-made, quick-break, and trip indicating. All 2- and 3-pole breakers shall have common trips. All single pole 15- and 20-amp breakers shall be UL listed for switched duty. Where indicated on plans furnish ground fault breakers UL listed in accordance with UL 943 Class A - Group 1, 5 millamp sensitivity.

   b. Provide circuit breakers and panels suitable for 75 degrees C wire at full NEC ampacity.

6. Drawings: Drawings shall be submitted showing: Mains - type and locations, schedule of branch devices, bus rating, lug sizes, box dimensions, and panelboard short circuit rating.

I. Supporting Devices

1. Expansion and/or Deflection Fittings

   a. O.Z. Gedney, Appleton, Spring City or equal.

2. Channel Support

   a. Unistrut, Kindorf, Super Strut, or equal. Supports shall be PVC coated galvanized steel or PVC coated aluminum. Uncoated galvanized steel shall not be used. Cut ends of supports shall be recoated with a PVC like coating. Stainless steel, type 316 may be used in lieu of PVC coated supports.

3. Fastening Devices

   a. Caddy, Appleton, or equal.

4. Cable Ties

   a. Panduit, Thomas & Betts, or equal.

J. Wall and Floor Seals

1. Wall seals are required for all wall penetrations below grade. Floor seals are not required for slab on grade penetrations but are required for floors below grade. Seals shall be Spring City, O.Z. Gedney, or equal.

K. Dry Type (General Purpose) Transformers

1. General

   a. This specification covers requirements for 600 volts class dry-type distribution transformers of the sizes, types and ratings as indicated on the applicable drawings.

   b. Transformers shall meet the latest applicable Standards of IEEE, NEMA, ANSI and UL.

2. Design Features

   a. Encapsulated, Totally Enclosed Types

      1) Transformers 0.5-25 kVA single-phase and 3-15 kVA three-phase shall have the core and coils totally enclosed, encapsulated.

      2) The case shall be steel with welded seams to provide a rugged design suitable for indoor or outdoor application.

      3) Insulation system and average winding temperature rise shall be manufacturer's standard.

      4) Construction shall consist of a core and coil assembly completely encapsulated in a mixture of electrical-grade resin and aggregate suitably proportioned to provide a hard, durable, airtight, shock free seal.

      5) Transformer leads shall be located in a terminal compartment below the core and coil assembly with provision for conduit connection to 90 degree C minimum insulation feeder cables.

   b. Open, Ventilated, Drip-Proof Types

      1) Single-phase transformers rated 37.5 kVA and above, and three-phase rated 30 kVA and above shall be enclosed in an open, ventilated, drip-proof enclosure, self bracing, with removable front and rear cover panels to provide easy access to a terminal compartment located below the core and coils
         .

   c. Sound Levels: Transformers shall have average sound levels that do not exceed the levels established by NEMA ST 20 and ANSI Standards.

   d. Voltage Taps

      1) Transformers shall have at least four 2 ½ percent voltage taps; two full-capacity above normal (FCAN) voltage rating, and two full-capacity below normal (FCBN) or as indicated on the drawings.

3. Finish

   a. Enclosure shall be degreased, cleaned, primed and finished with gray enamel paint.

4. Mounting

   a. Provide wall brackets for single-phase units 15 – 25 kVA and three-phase units rated 15 kVA. Larger transformers shall be floor-mounted.

5. Approved Manufacturer

   a. Cutler Hammer, Square D, GE, or approved equal.

L. Motor Starters

   1. See section entitled "Motor Starters and Motor Control Centers" of these Specifications.

M. Motor Control Centers

1. See section entitled “Motor Starters and Motor Control Centers” of these Specifications.

N. Terminal Blocks 0 to 600 Volts

1. Provide 600-volt terminal blocks for termination of all control circuits entering or leaving equipment, panels, or junction boxes. Provide screw clamp compression, dead front barrier-type terminal blocks with current bar providing direct contact with wire between the compression screw and yoke. Provide yoke, current bar and clamping screw constructed of high strength and high conductivity metal. Utilize yoke that guides all strands of wire into the terminal. Utilize yoke that guides all strands of wire into the terminal. Utilize current bar providing dependable vibration proof connection. Supply terminals constructed to allow connection of wire without any special preparation other than stripping. Rail mount individual terminals to create a complete assembly and provide terminals constructed such that jumpers can be installed with no loss of space on terminal or rail.

2. Size all terminal block components to allow insertion of all necessary wire sizes and types. Supply terminal blocks with marking system allowing the use of preprinted or field-marked tags. Supply CSA certified and UL approved terminal blocks.

O. Magnetic Contactors

1. NEMA ICS 2, UL 508

2. Electrically actuated by dual acting, single-coil mechanism.

3. Inherently interlocked.

4. Main Contacts:

   a. Power driven in both directions

   b. Double-break, continuous-duty, rated as shown on the Drawings, to withstand the RMS symmetrical values shown on the drawings.

   c. Marked for switching of electric discharge lamps and other resistive (non-motor) loads, such as radiant heaters.

   d. Position not dependent on gravity, hooks, latches, or semi-permanent magnets

   e. Capable of operating in any position

   f. Visual indication of each contact

5. Control: As shown on drawings

6. Provide one normally-open and one normally-closed auxiliary contact (for remote indication of status).

7. Enclosure:

   a. NEMA 250, Type 12, dust-tight, industrial use for dry areas

   b. NEMA 250, Type 4X for process areas

8. Cutler Hammer, Type CN35, GE, Class 360, or approved equal.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. See section entitled “Conduit” of these Specifications.

3.02 CUTTING AND PATCHING

A. Provide all cutting and patching required to perform this work.

B. Do not cut into any major structural element without approval of Engineer.

C. Patching shall be of quality equal to, and of appearance matching, existing construction.

3.03 EQUIPMENT MOUNTING

A. Wherever any electrical component, such as panels, raceways, pipes and conduits, will be in contact with surfaces which may become damp or wet, mount using spacers to hold electrical work ¼ inch away from damp surfaces.

3.04 PULL-BOXES, TERMINAL JUNCTION BOXES, DISCONNECT SWITCHES AND WIRING DEVICES

A. Furnish equipment and installation methods in accordance with the following (unless otherwise shown):

1. Indoor Finished Areas (Dry) NEMA 1
2. Indoor Unfinished Areas (Dry) NEMA 12
3. Indoor Wet Areas NEMA 4
4. Indoor Wet and Corrosive Areas NEMA 4X
5. Outdoor Areas NEMA 4X

END OF SECTION

SECTION 26 05 19

WIRE AND CABLE

PART 1 GENERAL

1.01 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install, connect, and test all wire and cable, including splices, terminations, connectors, and accessories for a complete installation as shown on the Drawings and/or specified herein.

B. The Contractor's attention is directed to the fact that all wires and cables are not necessarily shown on the Drawings, which are more or less schematic. However, the Contractor shall be responsible for furnishing and installing all wire and cable indicated or required to properly connect and place into operation all equipment and services requiring such wiring and/or cable.

1.02 QUALITY ASSURANCE

A. Samples of all wire and cable, clearly marked and long enough to show complete identification, shall be submitted to the office of the Engineer for approval prior to wiring installation.

B. No defective or damaged wire and cable shall be incorporated into the work.

1.03 SIZING OF CONDUCTORS

A. Unless otherwise required or directed by the Engineer, conductors shall be furnished in the sizes shown on the Drawings. No wire for lighting, power, or motor control circuits shall be smaller than No. 12 AWG. Motor control circuits carrying less than 8 amps may be No. 14 AWG. No wire for instrumentation and low-level signal transmission pairs shall be smaller than No. 16 AWG for single pairs or No. 20 AWG for bundled cable.

B. All wires and cables shall be of such size as to conform to the regulations of the current edition of the National Electrical Code for current carrying capacity.

C. Where the size of lighting wiring is not given on the Drawings, it shall be of such size that the voltage drop from the main panel to the lighting panel is not more than 1 percent, and the drop in the branch circuit is not more than 2 percent. The voltage drop in motor feeder, when the wire size is not specified, shall not be more than 3 percent at full load from the Motor Control Center to the motor terminal.

1.04 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted in accordance with requirements of the Section 01 33 00 of these Specifications.

1.05 STORAGE AND PROTECTION

A. Store and protect all wire and cable in accordance with the manufacturer's recommendations and requirements of the Section 01 60 00 of these Specifications.

B. Wire and cable shall be stored indoors in a dry and warm location and in its original packaging.

1.06 GUARANTEE

A. Provide a guarantee against defective materials and workmanship in accordance with requirements these Specifications.

PART 2 PRODUCTS

2.01 CONDUCTORS - GENERAL

A. Conductors shall be solid or Class B concentric stranded, soft or annealed, uncoated copper free from kinks and defects in accordance with ASTM B 3 or B 8.

B. Conductors should have a conductivity not less than 97 percent.

C. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's "E-Number" permanently marked on the outer covering at not more than 2-foot intervals.

D. All wires shall conform to the latest Standards of the ASTM and ICEA and shall be tested for their full length by these Standards.

E. Insulation thickness shall be not less than that specified by the National Electrical Code.

F. All control circuit wiring and all wiring No. 8 AWG and larger shall be stranded. Lighting branch circuits No. 12 and No. 10 AWG may be solid. Wiring shall be stranded as follows:
   1. No. 14 thru No. 2 AWG shall have a minimum of 7 strands.
   2. No. 1 thru No. 4/0 AWG shall have a minimum of 19 strands.
   3. No. 250 MCM thru No. 500 MCM shall have a minimum of 37 strands.
   4. All circuits except control and instrumentation circuits shall have a separate grounding conductor carried in the conduit.

2.02 CONDUCTORS FOR WIRE AND CABLE

A. XHHW - For service entrance, motor branch, and feeder circuits operating at 208, 240, and 480 volts, the conductors shall be single-conductor, cable rated, 600 volts. The single-conductor cable shall consist of uncoated annealed copper, Class B stranded per ASTM B 8 and insulated with corona, ozone, heat and moisture resisting cross-linked polyethylene insulation rated to withstand a copper temperature of 90 degrees C, Underwriter's approved Type XHHW and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company or equal.

B. THWN-2 - For general lighting and receptacle branch circuits operating at 115 volts, the conductor shall be single-conductor cable rated 600 volts. The single-conductor cable shall be uncoated annealed copper. No. 12 and No. 10 AWG may be solid, or stranded; larger cables shall be stranded per ASTM B 8 and insulated with polyvinyl chloride insulation rated to withstand a copper temperature of 75 degrees C, Underwriter's approved Type THWN-2, and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company, or equal.

C. For lighting fixture drop wire or for running in fluorescent units, the conductors shall be single-conductor cable rated 600 volts. The single-conductor cable shall be stranded tinned copper with a 31-mil-thick wall silicone insulation and a glass braid jacket overall rated to withstand a copper temperature of 150 degrees C, Underwriter's approved silicone insulated fixture wire type SFF-2, and shall be as manufactured by General Cable Corporation, General Electric Company, or equal.

D. For control circuits the conductors may be single or multi-conductor cable rated 600 volts. The conductors shall consist of uncoated annealed copper Class B stranded per ASTM B 8

and shall be No. 14 or No. 12 AWG, 7-strand, identified at each end using Brady wire markers B-500 vinyl cloth, Thomas and Betts “E-Z Code” wire markers, or equal.

1. Single-conductor cable shall have 45-mil-thick wall of cross-linked polyethylene or polyvinyl chloride insulation, color red, to withstand a copper temperature of 90 degrees C, Underwriter’s Laboratories approved Type RHH-RHW, and shall be as manufactured by General Electric Company, Phelps Dodge, General Cable, Okonite, or equal.
2. Multi-conductor cable shall consist of single-conductor cables rated 600 volts and insulated to withstand a copper temperature of 90 □C cabled together to form a cable assembly which is Underwriter’s Laboratories approved for installation in conduit. The core shall be color coded in accordance with ICEA, Method 1, with a plastic tape cover and a PVC or neoprene jacket overall.

E. Bare grounding conductor shall be Class A or B medium hard drawn, high conductivity bare copper, sized as shown on the Drawings. Conductors No. 6 AWG and smaller may be solid. Conductors No. 4 AWG and larger shall be stranded.

F. Flexible power cords shall be moisture-resistant, oil-resistant, neoprene-sheathed service cable designed for extra hard usage, Type SO, rated 600 volts at 90 degrees C continuous conductor temperature. Flexible heater cords shall be moisture-resistant, oil-resistant, neoprene and cotton sheathed service cable designed for extra hard usage, Type HSO, rated 600 volts at 90 degrees C continuous. Insulation shall be thermoplastic ethylene-propylene conforming to ICEA S-68-516. Neoprene shall conform to ASTM D 752. All flexible cords shall be UL listed.

2.03 INSTRUMENTATION AND THERMOCOUPLE EXTENSION WIRING

A. Instrumentation and low level DC signal wiring shall be shielded, twisted pair conductors. Single twisted pairs shall consist of 2, Class B stranded, No. 16 AWG annealed copper conductors, 1 white and 1 black, with 15 mils of PVC insulation rated for 600 volts and 90 degrees C minimum continuous conductor temperature. Pairs shall be twisted to a lay of 1.5 to 2.5 inches. A 0.35 mil by 0.50 mil aluminum-mylar tape shield with stranded, bare No. 18 AWG, tinned copper drain wire in contact with the aluminum side of the shield shall be applied helically around the twisted pair. An overall jacket of 90 degrees C black PVC at least 30 mils in thickness shall be applied to the outside. Shield coverage shall be full 100 percent. All instrumentation wiring shall be UL listed.

B. Twisted, Shielded Triad Instrumentation Cable for RTD circuits: Stranded copper conductors, size #16 AWG. Insulate conductors individually with color-coded PVC. Provide shield for each triad and tinned-copper drain wire. Provide flame-retardant PVC outer jacket. Cable shall be rated 600 volts and 90 degrees C. Cable shall be designed for noise rejection for use in process control signals.

2.04 AUDIO SIGNAL WIRING

A. Audio signal wiring for public address and sound systems shall be shielded, twisted pair instrumentation cable with 2 No. 16 AWG conductors constructed in accordance with the requirements of Part 2.3 of this section.

2.05 TELEPHONE AND COMMUNICATION WIRING

A. Indoor telephone and communication cable shall consist of solid, minimum No. 22 AWG, annealed copper conductors insulated and standard telephone color coded with polyethylene and twisted together in pairs. Pairs shall be cabled together and protected with a metal tape shield and a polyethylene or PVC jacket overall. Cable shall be suitable for installation in ducts.

B. Buried telephone cable shall be REA approved for aerial installation on messenger wire, installation in underground ducts, and direct burial. Cable shall consist of solid, minimum No.

22 AWG annealed copper conductors insulated and standard telephone color coded with polypropylene or polyethylene and twisted together in pairs. Each pair shall be twisted to a different lay length. Cable with more than 25 pairs shall be assembled from oscillated, bundled, 25-pair subunits. Bundled pairs shall be covered by a nonhygroscopic tape, an inner jacket of polyethylene, a shield of aluminum or tinned copper, and an outer jacket of black, high-molecular weight polyethylene copolymer. Cable core shall be completely filled with a nontoxic, petrolatum-polyethylene weatherproofing compound. Jacket shall be sequentially marked to indicate footage.

2.06 SPLICES AND TERMINATIONS

A. Splices, taps and attachment of fittings and lugs shall be electrically and mechanically secure, and approved solderless lugs and connectors shall be used. Lugs and connectors shall be top quality product of Burndy, O-Z, Thomas and Betts, or equal manufacturer. Conductors shall not bind at bushings. Lugs shall be of the correct sizes for the conductors joined and strands shall not be cut from a conductor.

B. Splices, taps, and terminations of cable rated 600 volts and less requiring tape shall be half lap and at least 3 layers. Taping shall be neatly done and form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:
   1. Rubber Insulation
      a. Inner Layer: Okonite Rubber Tape, 3M “Scotchfil” Electrical Insulation Putty, Plymouth “Plysafe” Tape, or equal.
      b. Outer Layer: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
      c. Thermoplastic Insulation: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
   2. Terminations at motor junction boxes shall be sealed with 3M “Scotchkote” Electrical Coating over the outer layer of tape. All splices 600 volts and less in No. 8 AWG and larger sizes shall be made using approved bolted connectors properly taped as specified herein.

C. For No. 10 AWG and smaller branch circuit and fixture conductors operating at 277 volts or less, live spring pressure connectors rated for 600 volts may be used for splices and junctions. When installed in a fixture, connectors shall be rated for 1,000 volts.

2.07 GROUND RODS

A. Ground rods shall be Copperweld, sectional type. Ground rods shall be UL listed and REA approved and shall conform to ANSI C33.8.

B. Connections between grounding conductors and grounding rods shall be mechanical if above ground, thermal if underground.

PART 3 EXECUTION

3.01 INSTALLATION

A. All interconnecting wiring shall be installed in approved conduit or cable trays and connected as shown on the Drawings and/or specified herein. Unless otherwise shown or specified, all wiring shall be run in conduit.

B. Unless otherwise shown on the Drawings, wiring shall be run by the most direct route keeping overall circuit length to a minimum.

C. Instrumentation and low level signal wiring shall not be located in the same conduit as motor wiring, feeder wiring, branch circuit wiring, or control wiring. Control wiring shall not be located in the same conduit as feeder wiring, or instrumentation wiring.

D. All control and circuit wiring in cabinets, boxes, gutters, etc. shall be neatly tied and held using nylon cable ties and mounting brackets.

E. After installation, conductors shall not have dents, scars, cuts, pressure indentations, abraded areas, etc.

F. Conductors 600 volts and below shall not be bent to a radius less than 12 times the cable diameter. Conductors above 600 volts shall not be bent to a radius of not less than 24 times the cable diameter.

G. Wiring run in metallic conduits shall be arranged such that there are an equal number of conductors of each phase in each conduit. Under no circumstances shall metallic conduits contain one single conductor or several conductors of only one phase. This requirement shall not apply to single, bare grounding conductors run in conduit to grounding rods or grids.

H. Conductors may be coated with talc, soapstone, Ideal “Yellow 77” or “Wire Lube”, Electro-Compound “Y-ER EAS,” or equal, to facilitate pulling into raceways, but in no case may they be greased or coated with any substance injurious to conductor insulation and jacket. Pulling tension shall be exerted primarily on the strongest component of conductors, normally the metallic conductors themselves and not on the insulation jacket. When installing cable in conduit with pulling eye attached to copper conductor, the tension shall not exceed 0.008 pound per circular mil area of the conductor nor 5,000 pounds, whichever is smaller. When a basket grip is used over the outer jacket of the cable, the maximum pulling tension shall not exceed 0.008 pound per circular mil area of the conductor nor 1,000 pounds, whichever is smaller. In no case shall pulling tensions recommended by the wire manufacturer be exceeded. The maximum sidewall pressure exerted on the insulation and sheath at a cable bend shall not exceed 300 pounds per foot of conduit bending radius. Conductors shall not be pulled “through” any outlet, condulet or box. Separate “pulls” shall be made on each side of such point.

I. Unless otherwise specified, splices shall be made at outlet or conduit boxes, pull or junction boxes, manholes, or vaults. No splice shall be drawn into a conduit. Splices in wiring rated 600 volts and below shall be made with enough spare wire for 2 splices to be remade with the wire at the same location.

J. All instrumentation and thermocouple extension wire shields shall be grounded. Shields on individual circuits shall be electrically continuous and shall be grounded at only 1 point in the circuit. Shields on thermocouple extension wire shall be grounded at the thermocouple only.

K. Surge suppressors shall be installed with the shortest line lead possible, but in no case longer than 18 inches unless otherwise shown on the drawings.

L. Inside manholes, all cables are to have racks with insulator supports. Supports are to be within 6 inches of each side of a splice and spaced not farther than 3 feet apart.

M. All conductors are to be identified. Branch circuits, motor feeders, and lightning wiring shall be identified by color coding consistent with the existing facility. If the facility is new, the color code shall be as follows:

	277/480V	**120/208/240V**
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Ground	Bare	Bare or Green

N. The color coding on No. 8 AWG and smaller conductors shall be continuous in length. No taping, painting or other means of coding will be acceptable. Conductors No. 6 AWG and larger and conductors operating above 600 volts shall be black with color coded tape visible at each point of access or view.

O. All circuits shall be identified at each termination and at all accessible locations such as manholes, hand holes, and pull-boxes. A circuit name shall be assigned based on the equipment at the load end of the circuit. Add a suffix letter if necessary to make the circuit number unique. Utilize sleeves for conductor sizes #2 AWG and smaller, and marker plates attached with nylon tie cords for larger conductor sizes. Taped-on markers or markers relying on adhesives shall not be allowed.

P. Conductors used for temporary construction power shall not be used for the permanent installation, and the permanent conductor system shall not be used for construction power unless authorized in writing by the Engineer. Circuit protective devices shall never be temporarily bypassed.

Q. Cables shall be pulled and installed without splices. Splices shall only be made with the Engineer's approval.

R. Apply fireproofing tape to cables in hand holes and manholes, and in other locations such as vaults, throughout their exposed length. Follow the tape manufacturer's installation instructions closely.

3.02 TESTING

A. Perform visual and mechanical inspection of each individual exposed power cable #6 AWG and larger for physical damage, correct terminations in accordance with the Drawings, cable bends in accordance with bending radius requirements, proper circuit identification, proper lug type, tightness of bolted connections with proper torque level per NETA ATS, Table 10.12 or manufacturer's specifications, and proper grounding.

B. Perform Insulation Resistance Testing of all conductors #6 AWG and larger with respect to ground and each adjacent conductor. Apply 1,000 volts dc for one minute on 600 volts insulated conductors in accordance with NETA. Minimum insulation resistance values shall not be less than 50 meg-ohms. Investigate all deviations between adjacent phases.

C. Perform Continuity test by ohmmeter method to ensure proper cable connections of all conductors #6 AWG and larger.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.01 STANDARDS

A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these Specifications and the contract drawings.

PART 2 PRODUCTS

2.01 CABLE AND EQUIPMENT

A. Use green colored and bare stranded copper conductors.

B. Use approved ground clamp manufactured for such purpose.

C. Use approved grounding electrodes and rod.

D. Make permanent ground connection with thermoweld method.

PART 3 EXECUTION

3.01 GENERAL

A. In general, alternating current circuits of 600 volts and below, surge suppressors, conductor raceway systems, and platform steel framework shall be effectively and permanently connected to a grounding system by means of copper conductors having cross section as required by the National Electrical Code and of capacity sufficient to ensure continuity and continued effectiveness of the ground connections under conditions of excess current. If some of the equipment to be grounded is not covered herein by detailed instructions or is not shown completely and clearly on the Drawings, such provisions of the National Electrical Code as may apply are to be considered minimum requirements for the work.

B. All metallic conduit systems, whether used for power or lighting wiring, shall be installed in such a manner as to produce electrical continuity and shall be bound together at one or more points and connected to the building system ground, except that isolated sections of conduit not exceeding 4 feet in length are not to be grounded or bonded unless specifically called for.

C. Rigid metal conduit systems made up with fittings, boxes, and apparatus housings having fully-threaded hubs need no additional provisions for continuity of ground. If the conduit system contains cutouts, pull boxes, junction boxes, switchboxes, etc., to which the conduit is fastened by means of locknuts and bushings, such interruptions in the grounding continuity shall be eliminated by bonding the conduit to the housings or by separately grounding each box and conduit sections, etc., that are so isolated. Grounding wedge lugs shall be used between all bushing and metal boxes. Paint and other nonconducting material shall be removed from the surface of conduit, fittings, and metal housings prior to connecting grounding clamps, straps, or other devices.

D. Equipment Grounding: Panel, starters, lighting fixtures, motor control center, etc., for power and lighting constitute the fundamental center of the associated distribution systems. As such, the metallic enclosures, frames, and other noncurrent carrying metal parts of this equipment

shall be connected by one or more grounding conductors to the grounding system. Install a ground connection from the ground bus of switchgears, MCCs, and other electrical panels with ground bus to the ground grid.

E. All motor frames shall be grounded. The ground conductor shall be run inside the conduit containing the power conductors. In the case of most 3-phase circuits, this means a fourth conductor in each branch circuit. The grounding conductor may be as large as the power conductor or as small as allowed by Section 250 of the NEC but shall not be smaller than No. 12 AWG. The grounding conductor shall be stranded, with green insulation through No. 4 AWG; larger sizes may be bare stranded. Ground connection at the motor shall be terminal lug or servit post inside motor conduit box and the other end connected to the ground bus in the motor control center.

F. Transformer Grounding: Bond the neutrals of outdoor substation transformers and distribution transformers within buildings to system ground network, and any additional grounding electrodes shown near the transformers. Connect the case of the transformer to the grounding system as well.

G. In making ground connections, the surfaces to all parts that will touch shall be thoroughly cleaned to ensure making good electrical contacts.

H. All clamped joints shall be made up firmly. Thermal joints shall be equal to CadWeld Type TA. Where exposed to mechanical injury, the grounding conductor shall be suitably protected by pipe or other substantial guard. If guards are iron pipe or other magnetic material, the grounding conductor shall be electrically connected to both ends of the guard to reduce impedance of the circuit.

I. Grounding conductors shall be without splice or joint if applicable and shall be straight and short except that when laid underground they shall be laid slack to prevent their being readily broken unless otherwise mechanically protected.

J. No fuse, switch, circuit breaker, or similar disconnecting devices shall be inserted in the grounding conductor or connection throughout the entire installation.

K. Grounding conductors shall be medium hard drawn, stranded bare copper wire sized as required by the National Electrical Code Article 250. Conductors Size No. 6 and smaller may be solid; Size No. 4 and larger shall be stranded. Ground wire shall be carried in conduit to the grounding point.

L. Ground rods where required, shall be of copper-clad steel not less than ¾-inch in diameter, 10 feet long or as shown on the Contract Drawings, and driven full length into the earth. The maximum resistance of a single driven ground shall not exceed 5 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, a minimum of 2 additional rods shall be installed not less than 10 feet on center. Connections between grounding conductors and ground rods shall be mechanical if exposed, thermal if buried.

M. Except where specifically indicated otherwise, all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment and shall be extended to driven rods on the exterior of the building.

N. All neutral conductor shall be continuous throughout the system and shall be grounded only at the point of origin of the service neutral.

O. All receptacles shall have provision for grounding conductor connection, and shall be grounded to the grounding conductor and outlet box.

P. All exposed steel columns, tanks, ladders, towers, and elevated platform shall be effectively grounded using No. 4/0 or larger bare copper grounding conductors and driven ground rods. Where multiple columns or tanks must be grounded, ground points shall be interconnected by minimum No. 4/0 bare copper grounding conductors buried approximately 18 inches below finished grade.

Q. Anchor bolts securing exposed electrical equipment, structures, metal enclosures, and tanks located outdoors shall be electrically connected to the steel reinforcement in the concrete foundation or footing. Connection shall consist of minimum No. 2/0 bare copper conductors and mechanical grounding clamps.

R. Surge arrestor ground terminals shall be connected to the equipment ground bus. Ground paths for lightning and surge arresters and capacitors shall be kept as short and direct as practical. If possible, arresters shall be connected in direct shunt relationship to the equipment terminals. Supporting brackets shall be connected directly to the equipment frame.

S. Grounding resistors, where specified, shall have a resistance within the boundary limits specified in IEEE Standard 142 in order to minimize transient overvoltages during ground faults. Ground fault current shall not be less than that required to operate protective devices or 25 amps, whichever is greater.

T. Lightning and surge arresters used with grounded-wye systems which do not have effectively grounded neutrals as defined by IEEE Standard 100 shall have a voltage rating not less that the maximum phase-to-phase voltage of the system.

U. The grounding system equivalent resistance shall not exceed 5 ohms for the entire system under normally dry conditions unless otherwise specified. After the grounding system has been installed and all connections made, tests shall be made by the Electrical Contractor to determine the resistance to earth. If the resistance of the entire system exceeds the specified maximum, additional ground rods shall be driven to reduce the resistance to this value.

V. Gas piping or piping conveying flammable liquids shall not be used as grounding electrodes.

W. The use of salts or electrolytes to reduce earth resistance shall not be permitted.

X. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).

Y. Install a ground rod inside each manhole. Connect any metallic raceway and all noncurrent-carrying metal parts to the ground rod with a No. 6 AWG (min.) copper conductor. Similarly, provide a ground rod for every pole-mounted site lighting and make grounding connections.

Z. Bond the standby generator neutral to the grounding system with a properly sized grounding conductor. Ground the generator frame to the ground grid.

AA. Ground metallic fences when used to enclose electrical equipment.

3.2 TESTING

A. Ground resistance testing shall be done in accordance with IEEE standard 81-1993 to confirm that the resistance of the grounding system is 10 ohms or less (test shall not be run within 72 hours of last rain fall). Ground resistance testing shall be done with the power off and the grounding electrode conductor isolated from the utility, and the service to prevent coupling. The testing equipment shall use the fall of potential method of earth resistance measurement. The test equipment must be designed to reject the effects of stray ac and dc currents on readings.

B. A test report shall be submitted to the engineer and included in the O & M manual for the project. The report shall include but not be limited to:

- Date of test
- Time of day
- Weather condition (ex. 82°F, 82% RH, cloudy)
- Date of last rain fall ≥ ½" in a 24 hour period
- Soil type
- Minimum of five (5) readings
- A plot of all readings indicating a level spot in the curve at the system resistance.

C. All ground resistance testing shall be done in the presence of the Engineer. If test measurements indicate a grounding system resistance of greater than 10 ohms, additional grounding cable shall be buried in locations and at the direction of the Engineer. Ground resistance testing as described herein shall be repeated after the additional ground cable has been installed. The installation of grounding cable and repeat testing shall be done until the 10 ohm grounding system resistance has been achieved.

D. Test equipment for ground resistance measurement shall be Vibroground by Associated Research, Megger null balance by Biddle, or alternate approved by the Engineer.

END OF SECTION

SECTION 26 05 33

BOXES

PART 1 GENERAL

1.1 SCOPE

A. All boxes required throughout the electrical raceway system shall be furnished and installed in accordance with the requirements which follow.

1.2 SECTION INCLUDES

A. Outlet boxes.

B. Pull and junction boxes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Boxes shall be equal to Appleton, Crouse Hinds, Raco, or Steel City.

2.2 MATERIALS

A. Outlet Boxes

1. Sheet Metal Outlet Boxes: NEMA OS-1, UL 514; galvanized steel, with ½ inch male fixture studs where required.
2. Cast Boxes: Cast feralloy with galvanized or cadmium finish, deep type, gasketed cover, threaded hubs for use with steel conduit, UL 514.
3. Floor Boxes: Full adjustable, steel, water and concrete tight equal to T&B model number 68 D.
4. Except as indicated otherwise on the drawings or in these specifications, all junction boxes or pull boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal for use with steel conduit.

B. Pull and Junction Boxes

1. Junction boxes and pull boxes shall be as indicated on the drawings and as specified in these specifications. Where no type or size is indicated elsewhere for junction boxes or pull boxes, they shall be in accordance with the requirements of the NEC, Article 314, Paragraphs 28, 29, 40 and 41 for use on systems with a nominal rating of 600 volts and less, and Section IV for use on systems with a nominal rating of over 600 volts.
   a. Sheet Metal Boxes: NEMA OS-1; galvanized steel. Boxes larger than 12-inches in any dimension are hinged enclosure. Equal to Hoffman Bulletin A-51.
   b. Cast Metal Boxes: NEMA 250; Type 4, galvanized cast iron box and cover, neoprene gasket, stainless steel cover screws, UL listed as raintight. Provide flat-flanged type for surface mounting

and outside flange recessed cover type for underground use. Boxes for sidewalk or other traffic areas to have appropriate duty cover with non-skid finish.

c. Corrosion Resistant Boxes: UL 508 Type 4X, gasketed screw cover. For boxes larger than 12-inches in any dimension provide hinge on one side and stainless steel toggle latches (equal to Hoffman A-FC412SS) on the other three sides. Equal to Type 304 stainless steel equal to Hoffman Bulletin A-51.

d. Floor Boxes: Floor boxes shall be cast iron with bolted covers. The boxes shall be approximately 12 inches square and 10 inches deep, and shall be located as shown on the drawings with the lid flush with the finished floor. Floor boxes shall be Neenah No. R-7517-DB or alternate acceptable to the Engineer.

2. Electrical enclosures, except junction boxes and pull boxes 4 inch trade size and smaller and other enclosures of cast metal, shall be constructed from steel plate reinforced as required to provide true surfaces and adequate support for devices mounted thereon.

3. Except as indicated otherwise in these specifications or on the drawings, all junction boxes and pull boxes larger than 4 inch trade size for use in indoor locations shall be sheet steel hot-dip galvanized after fabrication and those for use in outdoor or wet corrosive indoor locations shall be 316 stainless steel.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordination of Box Locations

1. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling and equipment connections.
2. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in. Coordinate mounting heights and locations of outlet mounted above counters, benches, backsplashes, and other furnishings. Any outlet may be relocated by up to 10 feet before it is permanently installed without incurring additional cost.

3.2 INSTALLATION

A. Box Installation

1. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
2. Locate boxes in masonry walls to require cutting of masonry unit comer only. Coordinate masonry cutting to achieve neat openings for boxes.
3. Support boxes independently of conduits openings.
4. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
5. In inaccessible ceiling areas, position outlets and junction boxes within 6-inches of recessed luminaires to be accessible through luminaire ceiling opening.
6. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish

thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

7. Align wall-mounted outlet boxes for switches, thermostats, and similar devices. Align adjacent devices at different elevations in one vertical line. Set floor boxes level and flush with finish flooring material.
8. Unless otherwise noted, use only cast outlet boxes. Galvanized steel boxes shall be used only in finished areas where they are completely concealed within walls or ceiling.
9. Conduit openings in boxes shall be made with a hole saw or shall be punched. Field locate holes in junction and pull boxes so as to afford the maximum bending radius for the conductors.
10. Boxes mounted on concrete shall be secured by self-drilling anchors. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both. Boxes larger than 4 inch trade size shall be leveled and fastened to the mounting surface with not less than 1/4 inch air space between the enclosure and mounting surface. All mounting holes in the enclosure shall be used.
11. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.
12. Label cover of junction boxes with circuit numbers of conductors in the box.
13. Unless indicated otherwise on the drawings or in these specifications, electrical enclosures except junction boxes and pull boxes 4 inch trade size and smaller, shall be as follows:

Location	Enclosure Type
Indoor (Nonhazardous) Dry Areas	NEMA 1
Areas where moisture conditions are more severe than those for which NEMA 1 enclosures are intended	NEMA 4
Wet, corrosive indoor areas	NEMA 4X SS
Outdoor (Nonhazardous)	NEMA 4X SS
Class 1, Division 2	NEMA 7

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install electrical conduit and fittings as specified herein and/or shown on the Drawings.

B. The Contractor's attention is called to the fact that all conduits and conduit fittings are not necessarily shown completely on the Drawings, as the Drawings are more or less schematic. However, the Contractor shall furnish and install all conduits and conduit fittings indicated or required for the proper connection and operation of the equipment.

1.02 SHOP DRAWINGS AND ENGINEERING DATA

A. Shop drawings and engineering data shall be submitted in accordance with requirements of the Section 01 33 00 of these Specifications.

1.03 STORAGE AND PROTECTION

A. Store and protect conduit and fittings in accordance with the manufacturer's recommendations and requirements of the Section 01 60 00 of these Specifications. Conduit shall be stored aboveground and adequately supported.

1.04 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with requirements of the Section 00 72 14 Article 23 of these Specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise shown or specified, all conduits shall be rigid metal. See the paragraph on Conduit Application for additional information.

B. Conduit terminations at electrical equipment such as electric motors, dry type transformers and heaters shall be made using liquid-tight, flexible metal conduit.

C. Damaged, dented, flattened, or kinked conduit shall not be used.

2.02 RIGID METAL CONDUIT

A. Rigid metal conduit shall be heavy wall, mild steel conduit conforming to ANSI C80.1 and Federal Specification WW-C-581, hot dip galvanized both inside and out. All conduits shall bear the approved stamp of the Underwriters Laboratories.

B. Rigid metal conduit shall be by Allied Tube & Conduit, Republic, or equal.

2.03 RIGID NONMETALLIC CONDUIT

A. Rigid nonmetallic conduit for voltages 600V and less shall be Schedule 40 heavy wall polyvinyl chloride (PVC) electrical conduit rated for 90 degrees C conductors and conforming to NEMA TC-2, Type EPC-40-PVC. It shall be listed by Underwriters Laboratories in conformance with the National Electrical Code. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduits shall be as manufactured by Carlon, Allied Tube and Conduit, Borg-Warner, or equal.

B. Rigid nonmetallic conduit for voltages higher than 600V shall be polyvinyl chloride (PVC) power duct rated for 90 degrees C conductors and conforming to NEMA TC-6, Type EB. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduit shall be as manufactured by Carlon, Olin, or equal.

2.04 PLASTIC-COATED RIGID METAL CONDUIT

A. Rigid metal conduit prior to application of plastic coating shall conform to Part 2.02, Rigid Metal Conduit, of this section.

B. Plastic coating shall be polyvinyl chloride (PVC) bonded to the metal a uniform thickness of 40 mils the full length of the conduit except the threads. The bond between the metal and PVC coating shall be equal or greater than the tensile strength of the PVC coating.

C. A coupling shall be furnished loose with each length of conduit and shall have a PVC sleeve extending 1 pipe diameter, or 2-inches, whichever is least, beyond the end of the coupling. Elbows shall have the same thickness of PVC coating as on the conduit. All threaded conduit and elbow ends shall have plastic thread protectors.

D. The rigid steel galvanized PVC coated conduit and fittings shall be KorKap as manufactured by Plastic Applicators, Houston, Texas; Plasti-Bond as manufactured by Pittsburgh Std. Div. of Robroy Industries, Verone, Pa.; or equal.

E. PVC-coated rigid conduit shall meet the ASTM D870 Boil Test.

2.05 RIGID ALUMINUM CONDUIT

A. Rigid aluminum conduit shall be manufactured of 6063 alloy in temper designation T-1. The fittings shall be of the same alloy.

B. All conduits shall bear the approved stamp of the Underwriters Laboratories and be manufactured to ANSI C80.5 and Federal Specification WW-C-540c.

C. Rigid Aluminum conduit shall be by Republic, Allied Tube and Conduit, or equal.

2.06 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Flexible conduit shall have an oil-resistant, liquid-tight jacket in combination with flexible metal reinforcing tubing and shall be designed for use with waterproof fittings. An integral ground wire shall be included. Flexible conduit shall be American Brass Sealtite Type UA as manufactured by Electric-Flex Company; Flexible Metallic Conduit as manufactured by Ideal Industries, Inc; or equal. Only Underwriter's Laboratories approved fittings shall be used.

2.07 CONDUIT FITTINGS AND BUSHINGS

A. Wherever conduits terminate in sheet steel boxes, double bonding type locknuts and bushings shall be used except when terminating in cast hubs. All bushings shall be insulated metallic type, equal to O. Z. Electrical Manufacturing Company, Type B; T & B Company, 1200 Series; Appleton Electric Company, Type BU-I; or equal.

B. Where conduits terminate in steel or cast NEMA 4 enclosures with no factory-installed threaded hubs, a threaded hub shall be installed equal to Myers Electric Products, Inc., Type ST or STG; Appleton Electric Company, Type HUB; Crouse-Hinds, Type HUB; or equal.

C. All conduits terminating at motor control centers shall be suitably grounded to the motor control center ground bus using grounded type insulated bushings equal to O. Z. Electrical Manufacturing Company, BLB or IGB; Appleton, Type BIB; Thomas and Betts, 3800 Series; or equal.

D. Conduit expansion fittings shall be O. Z. Electrical Manufacturing Company, Type EX with Bonding Jumper, Type XJ; Appleton, Type SJ with Type XJB4 Bonding Jumpers; Crouse-Hinds, Type XJ with GC100 Bonding Jumper; or equal.

E. All outdoor conduit penetrations shall enter the enclosures, panels, junction boxes from the bottom side. Top and side penetrations are not permitted without the Engineer's approval.

F. All outdoor conduit hubs shall be watertight Myers hubs.

2.08 CONDUIT BOXES

A. Exposed conduit boxes and pulling elbows shall be of die-cast, copper-free aluminum with threaded body and removable neoprene- gasketed cover. Conduit boxes shall conform to Federal Specification W-C-586a and shall be Crouse-Hinds "Condulet," Appleton "Unilet Form 85," or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Minimum size conduit shall be 3/4 inch aboveground and 1 inch below ground except where noted otherwise, and no conduit shall have more than 40 percent of its internal area occupied by conductors.

B. During construction all installed conduits shall be temporarily plugged, capped, or otherwise protected from the entrance of dust, trash, moisture, etc., and any conduits that may become clogged shall be replaced. No conductor shall be pulled in until all work that might cause damage to the conduit or conductors has been completed.

C. Conduit connections to sheet metal enclosures shall be securely fastened by double lock nuts inside and outside and shall have grounding bushings.

D. Conduit straps or brackets secured to concrete, brick, or masonry shall be by means of expansion bolts, toggle bolts, or approved drill anchors. No wood plugs will be permitted.

E. Conduits supported from building walls shall be installed with at least 1/4-inch clearance from the wall using pipe spacers equal to Appleton Electric Company, T & B Company, Steel City, or equal. Clamp back to prevent the accumulation of dirt and moisture behind the conduit.

F. Unless otherwise shown or specified, exposed rigid conduit shall be installed parallel or at right angles to structural members, surfaces, and building walls.

G. Two or more conduits in the same general routing shall be parallel with symmetrical bends.

H. Conduits shall be at least 12 inches from high temperature piping, ducts, and flues.

I. Conduit installed horizontally shall allow headroom of at least 7 feet, except where it may be installed along structures, piping, equipment, or in other areas where headroom cannot be maintained because of other considerations.

J. Wherever necessary conduit boxes and pulling elbows shall be inserted in the lines. Gaskets shall be used to ensure a dust and watertight installation on all conduit boxes and fittings.

K. All bends and turns in conduits shall have a bend radius of not less than 6 times the internal diameter of the conduit. Bends shall be made using an approved bender to provide smooth bends with no kinks, dents, or flattening.

L. All concealed conduit shall be placed in walls, floors, ceilings, or slabs at the proper time in accordance with the progress of the work. The Contractor shall cooperate in every respect in meeting schedules and shall not delay the structural work unnecessarily. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during pouring of the concrete. Where conduit interferes with structural steel, steel reinforcement, or in the opinion of the Engineer occupies too much space in the slab, the conduits shall be rearranged or installed exposed as directed by the Engineer. No additional payment will be made for such rearrangement of conduit whether or not additional conduit or fittings might be required.

M. Conduit wall seals with water stops shall be installed in outside walls below grade for all incoming or outgoing underground conduit emerging directly into the building area. The conduit wall seals shall have a pressure ring and sealing grommet to ensure a watertight installation.

N. Conduit expansion fittings and ground bonding jumpers shall be installed on all conduits passing through building expansion joints to provide movement in the conduit system.

O. Where groups of conduits terminate together or pass through floors, provide template to hold conduits in proper relation to each other and to building.

P. Conduits shall be plugged or capped with plastic caps during construction to protect threads and prevent entrance of dirt and water.

Q. Conduits shall be adequately supported at intervals as required by the National Electrical Code. One to two exposed conduits running parallel to each other may be supported by strap anchors, or 1-hole clamps (walls only). Exposed conduits larger than 2 inches or groups of more than 2 conduits run parallel shall be supported by means of minimum 12 gauge, slotted steel channels fitted with 2-piece, bolted pipe clamps. All conduit supports, clamps, straps and brackets shall be stainless steel for corrosion resistance.

R. Runs of conduit shall not contain more than four 90-degree bends (360-degrees total) between conduit boxes panelboards, or terminations. In general and to the extent practical length of conduit runs between conduit boxes or similar means of access shall not exceed 100 feet.

S. Exposed service entrance conduits and main feeder conduits shall be identified using stenciled letters at intervals not to exceed 20 feet. Size of letters shall be equal to one-half the diameter of the conduit or 2 inches, whichever is less.

T. In Class 1, Division 2 areas, the contractor is responsible for installing seal-off fittings as required by Articles 500, 501, and 502 of the National Electric Code. The drawings do not show seal off fittings and it is the contractor's responsibility to locate and install the seal-offs based on field routing of the conduit.

3.02 INSTALLATION OF RIGID METAL CONDUIT

A. Terminations and connections of rigid metal conduit shall be threaded. Conduits shall be reamed free of burrs and terminated with insulated metallic conduit bushings.

B. Conduit threads shall be coated with a petroleum base corrosion-inhibitor with low electrical contact resistance before assembly equal to Burndy Engineering Company, Inc., Penetrax "A" or equal screw thread lubricant (zinc-petroleum or zinc-chromate compounds are permissible).

C. All conduits shall be suitably grounded to the plant ground grid using grounded type insulated bushings, O. Z. Electrical Manufacturing Company, Type BLG or IGB, T & B Company, Appleton Electric Company, or equal.

D. Conduit across structural joints where structural movement is allowed shall have bonded, weathertight expansion and deflection fitting the same size as the conduit.

E. Support spacing for conduits 1 inch and smaller shall not exceed 6 feet, and conduits 1¼ inches and larger shall not exceed 10 feet. Supports shall be as specified under basic electrical materials and methods. Conduits 1½-inch and smaller may be supported by 1-hole conduit straps and 2 inches and larger shall be supported by 2-hole conduit straps. Conduit racks shall be as manufactured by Unistrut, Kindorf, or equal. Conduit racks shall be 316 stainless steel.

F. Conduit joints shall be made up tight using a pipe wrench. Channel lock pliers will not be permitted, and unions shall be used as necessary to aid in the installation. Conduits shall be cut square and the ends reamed smooth after threading to prevent injury to conductors. Conduit joints in concrete or exposed to weather or damp locations shall be drawn up tight and coated with insulating paint before casting in concrete or painting exposed conduit system.

G. Plastic-coated rigid metal conduit and fittings shall be installed in accordance with the manufacturer's specifications and recommendations. Any damage to the plastic coating shall be repaired in accordance with the manufacturer's requirements. The manufacturer shall certify the installers before installation can be started.

3.03 INSTALLATION OF RIGID NONMETALLIC CONDUIT

A. Field bending of polyvinyl chloride conduit shall be made with appropriate equipment. No torches or flame-type devices shall be used.

B. When joints are to be made with polyvinyl chloride conduit, the conduit shall be cut with a fine-tooth saw and deburred. Conduit ends shall be wiped clean of dust, dirt, and shavings and shall be dry. Solvent cement shall be applied to bond the joint. The joint should be watertight.

C. Polyvinyl chloride conduit shall be installed in accordance with the manufacturers' specifications and recommendations.

3.04 INSTALLATION OF LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Terminations at motors shall be made with flexible liquid-tight metal conduit from conduit stub to terminal box; flexible connection shall be made as short as possible. Flexible conduit shall be Type UA, black. Underwriter's Laboratories approved flexible liquid-tight conduit connectors shall be as manufactured by Thomas and Betts Company, Appleton Electric Company, or equal.

B. Uncoated flexible metal conduit may be used for short connections between junction boxes and lighting fixtures or speakers installed in suspending ceiling systems. Flexible metal conduit shall be connected using Underwriters Laboratories approved grounding connectors.

3.05 INSTALLATION OF UNDERGROUND CONDUIT

A. All underground conduits shall be concrete-encased unless otherwise noted on the Drawings or directed by the Engineer. No conduit shall be concealed or encased until the Engineer has inspected the conduit for proper installation and accurate placement.

B. The Contractor shall be responsible for all excavating, draining trenches, forming of duct assembly and protective concrete envelope, backfilling, and removal of excess earth.

C. Underground conduit shall be installed with a minimum 3-inch per 100-foot downward slope for drainage. Drains shall be provided at all low points.

D. Bends and turns shall be made using long sweeps. Ninety-degree bends will be used only where required and shall be kept at a minimum.

E. Where rigid nonmetallic conduits emerge from underground, an adapter from rigid nonmetallic conduit to rigid metal conduit shall be installed and all exposed conduit shall be rigid metal conduit.

F. All rigid metal conduit risers shall be protected with 2 coats of a Bitumastic compound before concrete is poured from a point 12 inches below grade to a point not less than 6 inches above grade or surface of concrete. All stub-ups shall extend upward with one length of rigid metal conduit until after concrete is poured to assure vertical alignment.

G. Conduits shall be encased in concrete with 3-inch minimum concrete cover all around.

H. Concrete for concrete encasement shall be Class B concrete conforming to requirements of the section entitled “Cast-In-Place Concrete,” of these Specifications. Longitudinal and lateral steel reinforcement shall be provided as shown on the Drawings.

I. All underground conduit runs for voltages less than 600 volts shall be at least 24 inches below grade and shall have a minimum conduit separation of 4 inches.

J. All underground conduit runs for voltages over 600 volts shall be at least 36 inches below grade and shall have a minimum conduit separation of 4 inches. Conduit shall have a minimum 4-inch concrete cover on all sides.

K. All underground conduit runs shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions that may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter ½ inch less than the inside diameter of the conduit.

L. All underground conduit runs shall be marked by a strip of permanently colored red polyethylene tape, 0.004 inch thick and 6 inches wide, buried above the conduit and 6 inches below finished grade.

M. All spare conduits shall be provided with permanent waterproof caps at stub-ups and shall be furnished with a No. 8 aluminum pulling wire. Waterproof raceway tags shall be attached to the pulling cords, at each end and at each intermediate pulling point. The raceway tags shall identify the origin and destination of the conduit.

3.06 CONDUIT APPLICATION

A. Install the following conduit types, unless otherwise shown on the drawings.
   1. Outdoors, Exposed (Not Buried): PVC Coated Rigid Conduit
   2. Indoors
      a. Dry Areas Galvanized Rigid Steel
      b. Wet Areas PVC Coated Rigid Conduit
   3. Underground (Under Slabs-on-Grade, Encased or Embedded in Concrete)
      a. PVC Schedule 40
   4. Hazardous Gas Areas
      a. PVC Coated Rigid Conduit
   5. Chemical Feed Areas
      a. PVC Coated Rigid Conduit
   6. Transition Areas and Final Connections to Equipment
      a. Motor Connections – Flexible metal, liquid-tight conduit.
      b. Light Fixture Connections – Flexible metal non liquid-tight conduit in dry areas and liquid-tight in wet areas.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

A. Panelboards shall be furnished in the quantities and with components, devices, and materials meeting the requirements indicated in the panelboard list on the drawings.

B. Panelboards shall be designed and fabricated in accordance with NEMA standards for panelboards. Each panelboard, or all current controlling devices in each panelboard, shall bear the UL label.

C. Panelboards shall be furnished with an integral power meter. See drawings for additional requirements.

1.2 SECTION INCLUDES

A. Panelboards.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

1.4 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of panelboards and devices herein specified shall be in accordance with the standards of the below listed organizations.

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturers Association (NEMA)
3. National Fire Protection Association (NFPA)
4. National Electrical Code, NFPA-70 (NEC)
5. Underwriters Laboratories, Inc. (UL)

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Equipment shall be manufactured by General Electric, Siemens, Square D, or Eaton/Cutler- Hammer.

2.2 MATERIALS

A. Panelboards: NEMA PB-1; UL 67.

B. Rating: Voltage and ampere ratings are shown on the Drawings. Unless otherwise indicated, interrupting ratings (RMS symmetrical) are 14,000 amps for 480 volt panelboards and 10,000 amps for 240 and 208 volt panelboards.

C. Cabinets: Indoor panelboards shall be in NEMA 1 cabinets. The cabinet shall be code gage gasketed steel. It shall consist of a box with a removable front complete with hinged door, latch and master keying lock. The box shall be flanged galvanized sheet steel. Boxes shall be a minimum of 20 inches wide and 5-7/8 inches deep. Code gauge galvanized steel; sized to accommodate devices indicated and afford wire bending space in accordance with NEC requirements.

Outdoor panelboards shall be in a NEMA 4X cabinet.

D. Fronts: Surface or flush as indicated, door-in-door construction, finished in light grey enamel over a rust inhibitor. Furnish flush lock for fronts less than 48-inches high and vault type handle with three point catch for fronts 48-inches and higher. Key all locks alike.

E. Bus:
1. Rigid buses of copper or copper alloy shall be installed to provide consecutive phasing of branch circuit connections.
2. The solid neutral bus shall have solderless connectors, numbered to agree with branch circuits. The bus shall be insulated from the cabinet with provisions for grounding.
3. The equipment grounding bus with main lug shall have solderless connectors, numbered to agree with branch circuits.

F. Circuit Breakers:
1. NEMA AB-1; molded case type, thermal-magnetic trip with internal common trip on multi-pole breakers.
2. Protective overcurrent devices for branch circuits shall be of the size and type indicated on the drawings.
3. Panelboard branch circuit breakers shall be the thermal magnetic, bolt-in, individually front replaceable type and shall indicate "On", "Off", and "Tripped". Circuit breakers indicated as multiple pole shall be common trip.
4. Continuous and interrupting ratings shall be as shown on the drawings. Provide breaker fully rated for interrupting ratings noted; series ratings are not acceptable.

G. Provide engraved nameplates giving the voltage rating and panel designation as indicated. Provide a UL service entrance label for panelboards used as service entrance equipment.

H. Surge Protection: Where indicated, provide transient voltage surge suppressors.

PART 3 EXECUTION

3.1 INSTALLATION

A. All panelboards shall be installed so that circuit breakers are not more than 6 feet above the finished floor and not lower than 24-inches above the floor. Panels shall be installed in accordance with the requirements of NEC Article 312 Paragraph 8, Article 408 and the following articles.

B. The cabinets shall be leveled and securely fastened to the mounting surface, utilizing all of the mounting holes provided in the panelboard cabinets.

C. Each cabinet shall be installed, conduits connected, and wires pulled before the panel interior is installed. A heavy cardboard panel front shall be temporarily secured to the front of the panelboard to protect the interior from dirt or damage until the permanent metal front is installed.

D. Each panelboard front shall be carefully aligned and adjusted until its edges are parallel to the panelboard interior and the building lines, and then shall be firmly secured with the fasteners provided.

E. For flush mounted panels provide a 3/4-inch empty raceway for each three unused spaces and spare poles. Terminate in a junction box located above the ceiling or other approved accessible location for future extension.

F. Prior to energizing panelboards clean out construction dirt and debris. Paint any scratches on the trims or dead front barriers. Megger each phase to phase and ground to insure that no short circuits exist.

G. Adjust panel barriers so that no openings occur between them and panel front. Provide filler plates and plugs as necessary to maintain dead front integrity.

H. A circuit directory cardholder and card with a clear plastic covering shall be provided on the inside of each cabinet door. The directory card shall provide a space to identify each circuit in the panelboard. The directory for each panelboard shall be accurately typed with the names of the load served by each breaker to permit ready location of the protective devices controlling circuit loads. Note spare circuits in pencil.

I. Each panelboard shall be identified with a suitable engraved nameplate mounted at the top of the front plate. Each nameplate shall be engraved with the panelboard identification indicated on the Contract Drawings.

END OF SECTION

SECTION 26 29 23

ADJUSTABLE FREQUENCY AC MOTOR DRIVE

PART 1 GENERAL

1.01 SCOPE

A. The contractor shall furnish and install all adjustable frequency AC motor drive equipment including accessory equipment, wiring and specialties as specified herein. All conduit and wiring between panels and between all AFDs (adjustable frequency drive) and motors, power supplies, and control panels shall be furnished and installed as required for a complete operating drive system.

B. The contractor shall be responsible for coordination of the AFD and its associated motor to match torque, speed, voltage, horsepower, current and other particular characteristics to meet the specified motor-driven equipment criteria. The minimum full load output current of the controller shall be equal to the equivalent motor horsepower plus 10 percent as listed by National Electrical Code Table 430-150 or the actual nameplate rating of the associated multipole motor, whichever is greater.

C. The adjustable frequency controller shall be UL and CSA certified and shall comply with the latest applicable standards of ANSI, IEEE and NEMA.

D. The adjustable frequency controller manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of the project, to provide start-up service, emergency service calls, repair work, service contracts, maintenance, and troubleshooting training of customer personnel.

E. All adjustable frequency drives shall be from the same manufacturer. Adjustable frequency controllers shall be Danfoss, Allen Bradley, Benshaw, Square D, or Eaton/Cutler-Hammer.

F. The VFD enclosure and side mount air conditioner shall not exceed 48” Wide x 24” Deep x 90” High.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 260000, General Electrical Provisions.

B. Section 260500, Basic Electrical Materials and Methods.

1.03 SUBMITTALS

A. Shop Drawings and data shall be submitted in accordance with the section entitled “Shop Drawings, Product Data and Samples” of these Specifications.

B. Complete drawings shall be furnished for approval and shall consist of wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the adjustable frequency controller. Suitable outline drawings showing details necessary to locate conduit stub ups and field wiring shall be furnished for approval before proceeding with manufacture.

C. Furnish system operating description and literature for all control devices.

D. Furnish all of the VFD configuration set-points after the final VFD configuration is complete.

1.04 NAMEPLATES

A. AFD controllers shall be supplied with embossed nameplates mounted in visible locations and containing as a minimum, the following information:

1. Manufacturer

2. Model Designation

3. Horsepower rating

4. Maximum Current Rating, Amperes

5. Power factor

6. Operating voltage

7. Frequency range

PART 2 PRODUCTS

2.01 ADJUSTABLE FREQUENCY DRIVES - GENERAL

A. Adjustable frequency drives shall be provided for equipment as shown on the drawings and equipment specifications.

B. Warranty

1. The drive manufacturer shall provide a complete warranty for a period of 1 year from the system substantial completion/Owner acceptance date. Warranty shall cover on-site service during working hours in the case of malfunction and include parts, labor and per diem expenses.

C. All drive components, including power factor correction, harmonic filter, and phase-shifting transformer shall be integral to the drive lineup, factory wired, and tested as a complete system.

D. The drives shall be suitable for use with any standard NEMA MG-1 Design B squirrel-cage induction motor having a 1.15 service factor and nameplate data as shown in the pump specifications. The drives can be located up to 300 feet from the motor without requiring special cabling or separate motor protection devices. Provide output line reactors if required to overcome the cable resonance problems (long-lead effect).

2.02 ADJUSTABLE FREQUENCY AC CONTROLLERS

A. General

1. The AFD motor controller shall convert 480 Volts, three-phase, 60-Hertz input power to an adjustable voltage (0 – 480 volts) and frequency (0 - 60 Hz.), three-phase, ac output power for step-less motor speed control with a capability of 10:1 speed range, under variable torque or constant torque load, as required by the driven equipment.

2. All drives shall be from the same manufacturer.

3. Provide drive systems consisting of AFD controllers and all auxiliary devices for a complete operating system. Coordinate with pump motor supplier and furnish drives rated on actual load nameplate current rating.

4. Other equipment is being powered from the same bus as the AFDs. Ensure proper operation of the drives and the other loads under normal and standby power source conditions.

5. The drive shall be variable torque and rated for pump applications.

B. Service Conditions

1. The controller shall be designed and constructed to operate within the following service conditions:

   a. Elevation up to 3300 feet without derating

   b. Ambient temperature range: 0°C to 40°C

   c. Atmosphere: Non-condensing relative humidity to 95%

   d. AC line voltage variation: -10% to +10%

   e. AC line frequency variation: ±3 Hertz

C. Drive Design

1. The adjustable frequency controller shall be a Pulse-Width Modulated (PWM) type converter design. Distributor or package modifications to a third-party standard product will not be acceptable. The inverter output shall be generated by Insulated Gate Bipolar Transistor (IGBT) technology.

2. The controller shall produce an adjustable ac voltage/frequency output. It shall have an output voltage regulator to maintain correct output volts/ Hz ratio despite incoming voltage variations.

3. The controller shall have a continuous output current rating of 100% of motor nameplate current.

4. Six pulse converters shall be acceptable for motor horsepower rating 100hp and less.

5. Provide clean power (18-pulse) converters for all motors rated above 100 hp.

6. Provide a 3% Input Line Reactor to attenuate line side transients and input current harmonics.

7. The drive system shall maintain a 0.95 minimum true power factor throughout the entire speed range.

8. Furnish an Input Circuit Breaker to disconnect incoming power and provide overcurrent protection for the drive. The Input Circuit Breaker shall be interlocked with the enclosure door, with a through-the-door handle to provide positive disconnect of incoming ac power. The circuit breaker shall be rated 42,000 Amps RMS symmetrical.

9. Furnish a side mounted air conditioner such that internal temperature is maintained at 85 degree F.

D. Enclosure

1. NEMA 250, type 1 enclosure.

   a. Wall-mounted for drive rating less than 50 hp.

   b. Freestanding for larger drives.

2. Provide side mounted air conditioner integral to enclosure.

E. Protective Features

1. The drive shall be able to withstand an open-circuited output that may occur during operation without damage.

2. The drive shall be to withstand a short-circuited output that may occur during operation without damage.

3. The drive shall be to withstand failure to connect to the motor without damage.

4. Instantaneous overcurrent and overvoltage trip.

5. Undervoltage and power loss protection.

6. Power unit overtemperature alarm and protection.

7. Responsive action to motor winding temperature detectors or thermostatic switches.

F. Controls and Operator Interface

1. Controls

   a. Mount drive local control on front door of enclosure and include control switch and membrane type keypad for the following minimum operator functions:

      1) Start and Stop (when in local mode)

      2) Speed Increase and Decrease (when in local mode)

      3) LOCAL/OFF/REMOTE control switch. In Remote position, accept a remote RUN command digital input and Speed Increase/ Decrease via remote a 4-to-20 mA analog signal.

      4) RUN at a preset speed.

      5) Fault RESET (Manual for all faults except for loss of ac voltage that shall be automatic upon return if within a preset time)

2. Password Protection

3. Control circuit disconnect shall de-energize circuits in units that are not de-energized by main power disconnect device.

4. Alphanumeric Display

a. During normal operation and routine test, the following parameters shall be available:

1) Motor current (percent of drive rated current)

2) Output frequency

3) Output voltage

4) Running time

5) Local/remote indicator

6) Status of digital inputs and outputs

7) Analog input and output values

5. Adjustable Parameters

a. Frequency, range, minimum, maximum.

b. Preset speed (adjustable, preset operating point).

c. Provision for adjustment of minimum and maximum pump speed to be furnished as function of 4-to-20 mA remote speed signal.

6. Historic Log and Fault Log

a. The drive shall record and display selectable control variables and fault information.

7. Power Circuits

a. Provide 120V single-phase ac circuit for motor space heater, if the motor is furnished with a space heater to prevent moisture condensation. Switch this circuit ON when the drive is not running.

b. Provide power for drive enclosure space heater

c. Provide 120V single-phase ac control voltage for motor thermistor relay.

G. Signal Interface

1. Digital Inputs

a. Accept a remote RUN command contract closure input

b. When motors (typically from 100 hp to 200 hp) are furnished with motor high temperature contact and/or field-mounted motor temperature monitoring relay, the drives shall include circuitry to interface with the temperature monitoring relay as required.

c. Accept a high discharge pressure input. Shut off drive the when high pressure persists for an adjustable preset time.

d. Drives for submersible dry pit and wet pit pump motors shall be furnished with circuitry to interface with the motor leak and temperature protection modules (such as the Flygt CAS module). Coordinate with the pump supplier and obtain the CAS

module for mounting in the VFD enclosure as required. See the pump schematic diagram shown on the drawings for additional information.

2. Digital Outputs

   a. Furnish discrete outputs for the following. Outputs shall be dry contact closures rated 5 amps at 120 volts ac.

      1) DRIVE RUNNING

      2) DRIVE OFF

      3) DRIVE FAULT (common contact for all fault conditions)

      4) DRIVE IN REMOTE MODE

      5) See Schematic Diagram for additional Outputs for monitoring of Submersible Motors (LEAK FAIL, HI BRG TEMP, HI WNDG TEMP).

3. Analog Inputs

   a. When LOCAL/OFF/REMOTE switch is in REMOTE, the drive speed shall be controlled from a remote 4-to-20 mA dc signal. Make provisions for adjustment of minimum and maximum motor speed that shall result from this signal.

   b. If the motor is provided with RTD's (generally for motors 250 hp and above), the drive shall include a Motor Protection Relay (MPR) to accept six RTD inputs and provide interlocking and output alarm contacts.

4. Analog Outputs

   a. Furnish two 4-20 mA speed signals as shown on the drawings.

5. Communications

   a. VFD's shall be provided with a Modbus via Ethernet communication module.

6. Auxiliary Relay

   a. Furnish a combination voltage/phase relay on the line side of the drive. See drawings for manufacturer and model number.

2.03 ON-SITE AFD STORAGE

A. The adjustable frequency controller shall be protected against damage at all times. The Controller shall be stored in a clean, dry environment with temperature and humidity within the range as specified by the controller manufacturer. Space heaters shall be energized during storage, as recommended by the manufacturer.

2.04 DRIVE SYSTEM SPARES

A. The manufacturer shall provide 1 spare for each plug-in type PC card in the unit. These spares shall be color-coded or otherwise keyed to its original counterpart such that improper installation of spare cards is impossible. In addition to the cards, the manufacturer shall provide 3 spares for all expendable items for each rating such as fuses, pilot lamps, and 3 complete power semi-conductor assemblies and 1 spare rectifier pack for each rating supplied.

B. All spare printed circuit cards shall be sealed in a conductive packing to prevent damage from static electricity and moisture.

C. All spares shall be clearly and permanently labeled on the outside of the packaging as to the manufacturer's name and equipment model number.

2.05 FACTORY TESTS AND CHECKS

A. Adjustable Frequency Controller power transistors, GTOs, SCRs, and diodes shall be 100 percent inspected and tested, including temperature cycling (0°C to 65°C) and ambient high temperature (65°C) load testing.

B. All integrated circuits shall be 100 percent inspected and tested.

C. All printed circuit boards shall be tested under a temperature cycling (0 to 60°C) 20-hour load test and then functionally tested via faultfinder bench equipment prior to unit installation.

D. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. Adjustable frequency controller shall trip electronically without device failure.

E. After all tests have been performed, each adjustable frequency controller shall undergo a 40-hour burn-in test.

F. After the burn-in cycle is complete, each adjustable frequency controller shall be put through a 30-minute cycling motor load test before inspection and shipping.

G. The adjustable frequency controller manufacturer shall provide certification that all of the testing above has been performed.

PART 3 EXECUTION

3.01 START-UP SERVICES

A. Testing, checkout, and start-up of the adjustable frequency controller equipment shall be performed under the technical direction of the manufacturer's service engineer. The drive system shall not be energized without authorization from the manufacturer's representative.

B. The adjustable frequency controller manufacturer shall provide at no additional cost to the owner, start-up service for all adjustable frequency controllers provided. Service shall include inspection, final adjustments, calibrating, programming, set-up, inputting motor setpoints, operational checks, functional checks of spare parts and a final report for record purposes. The service package shall include a 2-year parts warranty from date of shipment for all adjustable frequency controllers provided. A factory service engineer shall provide the start-up service. The engineer shall be permanently located within 250 miles of the installation for service after start-up, if required by the owner. The manufacturer shall include eight hours of start-up services for each pump station.

C. A copy of all test reports performed in the field, complete with meter readings, where applicable, shall be submitted to the owner for his record.

3.02 TRAINING

A. System supplier shall provide operation and maintenance training for owner's personnel to ensure their adequate knowledge of use of the system. Minimum training time shall be four hours.

END OF SECTION

SECTION 26 32 00

GENERATOR AND SERVICE ENTRANCE AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 REFERENCES

A. The equipment covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, U.L., IEEE and NEMA.

1.2 RELATED SECTIONS

A. Division 03 - Concrete

B. Division 23 – Mechanical

1.3 WORK INCLUDED

A. The work includes supplying a complete integrated emergency generator system. The system consists of a diesel generator set with related component accessories and A Service Entrance Automatic Transfer Switch as specified herein.

B. The Contractor shall provide a full tank of diesel fuel after the completion of all testing.

C. A complete system load test shall be performed after all equipment is installed.

D. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a Manufacturer who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

E. Provide four generator sets. One for each pump station.

F. The generator will be connected to an existing 500 gallon diesel tank. Provide all connections required including supply and return fuel lines.

1.4 MANUFACTURERS

A. There shall be one source responsibility for warranty, parts and service through a local representative with factory trained service personnel.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Listed in Alphabetical Order)

1. Generator Set:

   (a) Caterpillar

   (b) Kohler

   (c) Onan-Cummins

2. Service Entrance Automatic Transfer Switch:

   (a) ASCO

(b) Eaton/Cutler Hammer

(c) Thomson Technology

(d) Zenith

C. The Service Entrance Automatic Transfer Switch is based on Eaton. Other manufacturers are acceptable as long as the ATS fits the space allocated. If ATS is too large, Contractor shall provide a NEMA 3R ATS at no extra cost to the Owner.

1.5 SUBMITTALS

A. Engine-generator submittals shall include the following information:

1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
2. Manufacturer's catalog cut sheets of all auxiliary components such as Automatic Transfer Switches, battery charger, control panel, enclosure, main circuit breaker, etc.
3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
4. Weights of all equipment.
5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, jacket water heater, remote alarm indications.
7. Engine mechanical data including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactances, and time constants.
10. Generator motor starting capability.
11. Control panel schematics.
12. Oil sampling analysis, laboratory location, and information.
13. Manufacturer's and dealer's written warranty.

1.6 WARRANTY

A. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of substantial completion and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Warranty service calls shall not include a deductible cost. Submittals received without written warranties as specified will be rejected in their entirety.

1.7 PARTS AND SERVICE QUALIFICATIONS

A. The engine-generator supplier shall have service facilities within 75 miles of the project site and maintain 24-hour parts and service capability. The distributor shall stock parts as needed to support the generator set package for this specific project.

B. The dealer shall maintain qualified, factory trained service personnel that can be reached within 10 minutes of an emergency call and can respond on site within 4 hours of notification, 24 hours per day.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The generator set shall be Standby and have a 350 kW rating as shown on the one line diagram. The ratings shall be at 1800 RPM, 0.8 power factor, 480Y/277 VAC, 3 phase, 4 wire, 60 hertz, including radiator fan and all parasitic loads.

B. All materials and parts comprising the unit shall be new and unused.

2.2 DIESEL ENGINE

A. The engine shall be as manufactured by one of the approved manufacturers listed above. The engine shall be water-cooled inline or vee-type, four cycle compression ignition diesel. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, gear-driven water pump.

B. The engine shall include a Closed Crankcase Ventillation (CCV) system. If the engine does not have integral CCV, an exteernal system, by Racor or equal, shall be added. System shall filter crankcase fumes, returning the filtered air to the engine intake and the captured oil back to the oil pan.

C. The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.

D. The engine shall utilize a gear-type, positive displacement, full pressure lubricating oil pump and water-cooled lube oil cooler. Pistons shall be spray-cooled. Provide oil filters, oil pressure gauge, dipstick and oil drain.

E. Fuel filter and serviceable fuel system components shall be located to prevent fuel from spilling onto generator set batteries.

F. The engine shall be equipped with an isochronous electronic governor to maintain 0% droop from no load to full load and +/- 0.25% steady state frequency variation. The governor shall be equipped with speed adjustment.

2.3 GENERATOR

A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling.

B. The insulation material shall meet NEMA standards for Class H insulation and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (105° C rise by resistance over 40° C ambient). The excitation system shall be of brushless construction.

C. The brushless exciter shall be independent of main stator windings (either permanent magnet or auxiliary windings) and shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to

sustain short circuit current of 300% of rated current to allow protective devices to operate.

D. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design which includes electronic voltage buildup, volts per Hertz regulation, three phase sensing, over-excitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed.

2.4 CIRCUIT BREAKER

A. Provide a generator mounted circuit breaker, molded case or insulated case construction. Breaker(s) shall be 100% rated, UL Listed and sized as shown on the drawing(s). Breaker shall include a 12 or 24 VDC shunt trip, and shall have auxiliary position contacts wired to the genset control panel for local and remote annunciation of the circuit breaker position. The breaker shall be connected to engine/generator safety shutdowns. Breaker shall be housed in NEMA 1P22, enclosure(s)mounted on the side of the generator. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing(s), shall be supplied on the load side of breaker. Breaker shall include long term, short term, and instantaneous.trip settings. All breakers rated 1000 Amps and above shall include ground fault indication.

2.5 CONTROLS

A. Generator Mounted Control Panel:

1. Provide a generator mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, adjustable cycle cranking, digital LCD AC metering (0.5% true rms accuracy) with phase selector switch, digital engine monitoring, shutdown sensors and alarms with horn and reset, adjustable cooldown timer and emergency stop push-button. Panel shall incorporate self-diagnostics capabilities and fault logging. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged lid.
2. Provide the following digital readouts on the Generator Mounted Control Panel:
   Engine oil pressure
   Coolant temperature
   Engine RPM
   System DC Volts
   Engine running hours
   Generator AC volts
   Generator AC amps
   Generator frequency
3. Control Panel Annunciation - Provide the following indications for protection and diagnostics according to NFPA 110 level 1:
   Low oil pressure
   High water temperature
   Low coolant level
   Overspeed
   Overcrank
   Emergency stop depressed
   Approaching high coolant temperature

Approaching low oil pressure
Low coolant temperature
Low voltage in battery
Control switch not in auto. position
Low fuel main tank
Battery charger ac failure
High battery voltage
Generator supplying load
Spare

2.6 COOLING SYSTEM

A. The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 122° F ambient air entering the room or enclosure (If an enclosure is specified) without derating the unit and 50/50 anti-freeze mixture. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.7 FUEL SYSTEM

A. Filter/Separator - In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine.

B. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted.

C. Flexible fuel lines shall be rated for 300 degrees F and 100 PSI.

2.8 500 GALLON SKID MOUNTED DAY TANK (LOCATED IN HOUSING) DESIGNED TO PULL FUEL FROM EXISTING 500 GALLON CON-VAULT TANK: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:

A. Allocation: A separate day tank shall be provided for each engine generator.

B. Containment: Integral rupture basin with capacity of 150 percent of nominal capacity of day tank.

1. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

C. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 4 hours operation at 100 percent of rated power output of engine-generator system without being refilled.

D. Pump Capacity: Minimum 2 GPM with 20 foot lift, driven by 1/4HP, 120/240V, 1 Phase motor. Provide single point power connection.

E. Control: Provide with on/off/emergency run switch, test/reset switch, AC circuit breaker, DC circuit breaker, and the following indicator lamps:

1. Ready (Green) – AC Supply and DC Control Power Available
2. High Fuel (Red) – Latching fault, indicates fuel level near overflow, shuts down pump ,and closes N/O dry contacts
3. Low Fuel (Red) – Latching fault, indicates pump failure or operating float switch failure, closes N/O dry contacts.
4. Low Fuel Shutdown (Red) – Latching fault, indicates near empty tank, closes N/O contacts which may be used to shutdown engine generator to avoid air in

the injection system.

5. Overflow To Basin (red) – latching fault, indicates fuel in overflow/rupture basin, shuts down pump, closes N/O dry contacts
6. Spare (Red) – with N/O and N/C dry contacts
7. Pump Running (Green)

F. Piping Connections: Field-installed fuel supply and return lines from tank to engine; local fuel fill, and vent lines in compliance with local code requirements.

G. A dual wall fuel tank base of 500 gallons shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. The tank shall be pressure tested for leaks prior to shipment and have all necessary venting per UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

2.9 EXHAUST SYSTEM

A. A critical type silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation.

B. The silencer shall be located inside the generator set enclosure. The silencer shall be mounted so that its weight is not supported by the engine.

C. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine manufacturer.

2.10 STARTING SYSTEM

A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Jacket Water Heater: A unit mounted thermal circulation type water heater. The heater watt rating shall be sized by the manufacturer to maintain jacket water temperature at 90 degrees F in an ambient temperature down to -20 Deg F. Heaters <= 6000W shall be 208 – 240V single phase, 60 Hz. Heaters greater than 6000W shall be 208 – 240V, three phase, 60 Hz.

C. Batteries: A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 140 ampere hours and 1300 CCA. Necessary cables and clamps shall be provided.

D. A battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall treated to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over battery electrolyte shall be contained within the tray to prevent a direct path to ground.

E. Battery Charger: A current limiting battery charger shall be furnish to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. Ac input voltage shall be 120 volts, single phase. Charger shall have LED annunciation for low DC volts, rectifier failure, loss of AC power, high DC volts. Amperage output shall be no less than ten (10) amperes. Charger shall be wall mounting type in NEMA 1 enclosure, installed in the generator set enclosure.

2.11 GENERATOR SET ENCLOSURE – SOUND ATTENUATED AND WEATHER PROTECTIVE

A. The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, weather protective enclosure mounted on the fuel tank base.

B. The enclosure shall be constructed of corrosion resistant steel with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.

C. The enclosure shall reduce the ambient noise level at full load to a maximum of 75 dB at 23 feet.

D. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls and shall be reinforced for rigidity.

E. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if necessary.

F. Air handling will be sized and designed by the manufacturer for 0.5” static pressure drop through enclosure.

G. Air intake openings shall include fixed louvers with motorized dampers (120VAC power to close, fail open) and shall be screened to prevent the entrance of rodents.

H. Radiator air exhaust shall include fixed louvers with gravity type dampers, and sound attenuated exhaust plenum with vertical discharge.

I. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.

J. Lifting points shall be provided on base frame suitable for lifting combined weight of base tank, generator set and enclosure.

K. The genset enclosure and fuel tank base shall be constructed such that the height of the top of the genset control panel, all circuit breaker handles, and the oil level dipstick shall be no higher than 6’ above the genset pad. If these items are above 6’ the genset vendor shall supply a service access platform. The platform shall be of aluminum construction, shall be a minimum of 48” wide, shall provide room for full enclosure door opening, and shall include stairs and handrails per OSHA requirements. Platforms will be required on all sides / ends of the enclosure with door openings. Platform height shall be such that the control panel, breaker handle(s), and oil level dipstick shall all be within 6’ from the top of the platform after installation. Installing contractor shall coordinate any additional concrete requirements to support the platform with generator supplier..

2.12 SERVICE ENTRANCE AUTOMATIC TRANSFER SWITCH

A. GENERAL

1. The transfer switch shall be rated for the voltage and ampacity (600Amps) as shown on the plans and shall have 600 volt insulation on all parts in accordance with NEMA standards.
2. The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards.

Designs which require cabinet ventilation are unacceptable and do not meet this specification.

3. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
4. As a precondition for approval, all transfer switches complete with accessories shall be listed by Underwriters Laboratories, under Standard UL 1008 (automatic transfer switches) and approved for use on emergency systems.
5. The withstand current capacity of the main contacts shall not be less than 20 times the continuous duty rating when coordinated with any molded case circuit breaker established by certified test data.
6. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
7. Transfer switches shall comply with the applicable standards of UL, CSA, ANSI, NFPA, IEEE, NEMA and IEC.
8. The transfer switches shall be supplied with a solid state control panel as detailed further in these specifications.

B. SEQUENCE OF OPERATION

1. The ATS shall incorporate adjustable three phase under-voltage sensing of the normal source.
2. When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
3. The ATS shall incorporate adjustable single phase under-voltage sensing of the emergency source.
4. When the emergency source has reached a voltage value within 10% of nominal voltage and achieved frequency within 5% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
5. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be re-transferred to the normal source after a time delay of 0 to 30 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
6. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.
7. The transfer switch shall be equipped with a solid state control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position and source availability.
8. The control panel shall include indicators for timing functions, and ATS test switch.
9. The control panel shall be provided with calibrated pots (accessible only by first opening the lockable cabinet door) to set time delays, voltage and frequency sensors. The ATS shall be capable of being adjusted while the controls are energized and the unit in automatic mode. Designs which force a “programming mode” or require the controls be de-energized during adjustment are unacceptable.
10. The control panel shall be opto-isolated from its inputs to reduce susceptibility to electrical noise and provided with the following inherent control functions and capabilities:
    a. An LED display for continuous monitoring of the ATS functions.

b. Test switch to simulate a normal source failure.
c. Time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds (continuously adjustable via a calibrated potentiometer factory set at 3 seconds.
d. Time delay on retransfer to normal source, continuously adjustable 0-30 minutes, factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
e. Time delay on transfer to emergency, continuously adjustable 0-15 seconds, factory set at 1 second.
f. An in-phase monitor or time delayed neutral shall be provided to prevent excessive transient currents from switching motor loads.
g. An interval-type automatic clock exerciser with load/no load selectability shall be incorporated in the ATS.

C. CONSTRUCTION AND PERFORMANCE

1. The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
2. The transfer switch shall incorporate a timed, center-off (neutral) position to allow for motor and inductive load decay. Transfer time shall be adjustable from 0 to 10 minutes on transfer to either source. A mechanical interlock shall be provided to positively ensure that both sets of power transfer contacts cannot be closed simultaneously (precluding the possibility of inadvertently paralleling the ATS input sources).

3. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
4. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
5. The transfer switch manufacturer shall submit test data for each size switch required for this project, showing that it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Minimum UL listed withstand and close into fault ratings shall be as follows:

Any Molded Case Breaker*:

Size (Amps)	(RMS Symmetrical)
Up to 200	10,000
201 - 260	35,000
261 - 400	35,000
401 - 1200	50,000
1201 - 4000	100,000

Specific Coordinated Breaker*:

Size (Amps)	(RMS Symmetrical)
Up to 150	30,000

151 - 260	42,000
261 – 400	50,000
401 - 800	65,000
801 - 1200	85,000
1201 - 4000	100,000

Current Limiting Fuse*:

Size (Amps)	(RMS Symmetrical)
Up to 4000	200,000

*All values 480 volt, RMS symmetrical, less than 20% power factor.
Note: Actual necessary current withstand ratings for this project may be higher than the minimums listed above. Refer to electrical plans for exact requirements.

6. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
7. All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
8. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
9. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
10. The switch shall be mounted in a NEMA 1 indoor enclosure unless otherwise indicated on the plans.
11. Switches composed of molded case breakers, contactors or components thereof not specifically designed as an automatic transfer switch will not be acceptable.
12. To afford the advantage of a single source of supply to the owner, the automatic transfer switch shall be supplied by the manufacturer of the engine generator set and covered under the same warranty program.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes. Installation of the system includes but is not limited to pouring a concrete pad for the generator set and automatic transfer switch, receiving and offloading the equipment, providing all labor, permits and material to install the total system.

3.2 START-UP AND TESTING

A. Coordinate all start-up and testing activities with the Engineer and Owner.

B. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:

1. Verify that the equipment is installed properly.

2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.
3. Test all alarms and safety shutdown devices for proper operation and annunciation.
4. Check all fluid levels.
5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
7. Connect the generator to building load and verify that the generator will start and run all designated loads in the plant.

C. Perform a 4 hour resistive load bank test at full nameplate load using a load bank and cables supplied by the local generator dealer. Observe and record the following data at 15 minute intervals:

1. Service meter hours
2. Volts AC - All phases
3. Amps AC - All phases
4. Frequency
5. Power factor or Vars
6. Jacket water temperature
7. Oil Pressure
8. Fuel pressure
9. Ambient temperature

D. Operation and Maintenance Manuals

1. Provide three (3) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 1 Section "Demonstration and Training."

1. Train Owner’s maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 1 Section “Operation and Maintenance Data”.
3. Schedule training with Owner, with at least seven days’ advance notice.
4. Minimum Instruction Period: Four hours.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install all lighting equipment, fixtures, lamps, outlet boxes, hangers, and all related work for a complete installation.

1.02 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with requirements of the section entitled “Shop Drawings, Product Data and Samples” of these Specifications.

B. The Contractor shall submit for review and approval, a complete list of fixtures he intends to furnish, including technical specifications, assembly details, and photometric data.

1.03 STORAGE AND PROTECTION

A. Lighting equipment shall be stored and protected in accordance with requirements of the section entitled “General Equipment Stipulations” of these Specifications.

1.04 GUARANTEE

A. Provide a guarantee against defective or deficient workmanship and products in accordance with requirements of the section entitled “Warranties and Bonds” of these Specifications.

PART 2 PRODUCTS

2.01 FIXTURES

A. Interior lighting fixtures of types and sizes as indicated on the fixture schedule shall be furnished and installed complete.

B. All lighting fixtures, lampholders and accessories are to be Underwriters Laboratories approved.

C. Unless called for otherwise, all pendant mounted fixtures shall be equipped with stem. Aligners shall be used on all pendant mounted fixtures hung from irregular or sloping ceilings.

D. The fluorescent and high intensity discharge fixtures shall be complete with ETL-UL approved constant wattage ballasts and lamps as indicated on the schedule.

E. Vapor-proof units shall have galvanized malleable iron or cast aluminum hood, glass globe and aluminum guards or as called for in the fixture schedule.

F. All lighting fixtures which accommodate the use of gaskets shall be properly fitted with gaskets of an approved material.

2.02 LAMPS

A. All lighting fixtures shall be provided with lamps of the proper type and wattage, as noted on the Drawings. Any lamps broken previous to the final acceptance of the work shall be replaced by the Contractor at his own expense.

B. Incandescent lamps shall be wired with screw shell connected to neutral conductors. They shall be supplied with standard inside frosted lamps of wattage indicated, unless otherwise specified.

C. Unless otherwise noted, fluorescent lamps shall be standard cool white.

D. High intensity discharge lamps shall be sized as indicated on the schedule and suitable for the application indicated on the Drawings.

2.03 BALLASTS

A. All fluorescent ballasts shall be electronic and shall bear the “CBM” and “ETL” labels. The ballasts shall be listed by Underwriters’ Laboratories and shall meet all applicable ANSI lamp and ballast specifications as included in CBM requirements.

B. The ballasts shall be sound rated and this sound group rating indicated on the ballast. The ballasts specified shall have the lowest sound rating consistent with the requirements of the application.

C. All HID ballasts shall carry the “CBM” and “ETL” labels. The ballasts must be tested by the Underwriters’ Laboratories.

2.04 CONTROLS

A. Photoelectric control shall be provided where indicated on the Drawings.

2.05 SPARE PARTS

A. The Contractor shall provide 2 spare lamps of each voltage and type required.

B. Lamps shall be suitably protected against impact for long-term storage.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall coordinate all work to assure a finished, neat appearance. Lamps, ballasts, mounting rings, fuses and other essentials shall be provided to entirely complete the lighting work in a workmanlike manner.

B. The Contractor shall verify the final ceiling and finish schedules to insure the proper installation and mounting of fixtures; and shall coordinate with the Ceiling Contractor before making submittals.

C. Suspended fixtures shall be supported at not more than 4-foot intervals.

D. Pendant, chain or suspended fixtures shall be installed with a minimum clearance from bottom of fixture to floor as shown on Drawings.

E. All fixtures shall be adequately supported in an approved manner whether or not the method or type of support is specified or detailed.

F. The locations of lighting fixtures shall be shown in general on the Drawings. These locations shall be checked by the Engineer at the time of installation and shall be varied within reasonable limits so as to miss piping or other obstructions without extra cost to the Owner.

G. Contractor shall specifically adhere to manufacturer's instructions and wiring diagrams where required.

H. Install all lamps at the time fixtures are mounted. All burned-out lamps shall be replaced by the Contractor before the work is accepted by the Owner.

END OF SECTION

SECTION 31 00 00

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Base course for asphalt paving.
2. Excavating and backfilling trenches for buried utilities and pits for buried utility structures.

B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls."
2. Division 31 Section "Excavation Support and Protection."

1.3 DEFINITIONS

Backfill: Soil materials used to fill an excavation.
Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
Final Backfill: Backfill placed over initial backfill to fill a trench.

Base Course: Layer placed between the subbase course and asphalt paving.

Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

Excavation: Removal of material encountered above subgrade elevations.
1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer or Owner. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer or Owner. Unauthorized excavation, as well as remedial work directed by Engineer or Owner, shall be without additional compensation.

Fill: Soil materials used to raise existing grades.

Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cu. yd. or more in volume that cannot be removed by a backhoe.

Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

Utilities include underground pipes, conduits, ducts, and cables.

1.4 SUBMITTALS

A. Blasting plan approved by authorities having jurisdiction, for record purposes.

1.5 QUALITY ASSURANCE

A. Comply with applicable requirements of NFPA 495, "Explosive Materials Code."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify the Engineer and Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

C. Backfill and Fill: Satisfactory soil materials.
   1. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch(38-mm) sieve and not more than 12 percent passing a No. 200(0.075-mm) sieve.
   2. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch(38-mm) sieve and not more than 8 percent passing a No. 200(0.075-mm) sieve.

3. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, ASTM D 2940, except with 100 percent passing a 1-inch (25-mm) sieve and not more than 5 percent passing a No. 8 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
   3. Meet the requirements of Georgia Environmental Protection Division for stormwater discharge from construction-related activities.

3.3 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
   1. Do not damage adjacent structures, property, or site improvements or weaken the bearing capacity of rock subgrade when using explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   1. Clearance: 6 inches on each side of pipe or conduit.

C. Trench Bottoms: In soil excavate trenches to required elevation. Hand excavate for bell of pipe.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Surveying locations of underground utilities for record documents.
   2. Inspecting underground utilities.
   3. Removing concrete formwork.
   4. Removing trash and debris.
   5. Removing temporary shoring and bracing, and sheeting.

3.9 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Provide a complete stone backfill for piping within driveways, roadways, and parking areas.

C. Place and compact initial backfill of material, free of particles larger than 2 inches to a height of 12 inches over the utility pipe.
   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping to avoid damage or displacement of utility system.
   2. Coordinate backfilling with utilities testing.
   3. If in roadway or paved area backfill entire trench with No. 67 stone to a height 12 inches below road surface. Final 12 inches shall be filled with compacted road base stone.
   4. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed. Maximum dimension of individual rock in backfill from 12 inches above pipe to top of ground shall not exceed 6 inches.
   5. Place and compact final backfill of satisfactory soil material to final subgrade.

6. Whenever excavation has been made within easements on private property, the top 1 inch of backfill material shall consist of fine, loose earth, free from large clods, vegetable matter, debris, stone, or other objectionable material.
7. Whenever trenches cut across or along paved areas, temporarily pave the top 12 inches of trenches with Class A, Grade D crushed stone.

3.10 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Compact soil to not less than the following percentages of 95 percent density according to ASTM D 698:
   1. Under pavements, compact each layer of backfill or fill material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.13 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
   1. Place base course material over subbase.
   2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
   3. Shape subbase and base to required crown elevations and cross-slope grades.
   4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.

5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing. Contractor to pay for testing services.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.15 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Owner; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes temporary excavation support and protection systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of: supporting excavation sidewalls, resisting soil and hydrostatic pressure, and supporting superimposed and construction loads.

B. Provide professional engineering services to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer, as directed by the Engineer.

1.3 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1.4 PROJECT CONDITIONS

A. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks, as applicable. Clearly identify benchmarks and record existing elevations.

B. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Owner if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

C. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or

other evidence of movement to ensure that excavation support and protection systems remain stable.

D. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

END OF SECTION

SECTION 32 13 13

WALKS AND PADS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Refer to the drawings to determine the extent of the work specified under this heading.

B. Coordinate this work with equipment installation schedules for pad completion.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS

A. Concrete: As specified elsewhere.

B. Granular Fill: As specified elsewhere.

C. Joint Fillers: Fiberboard of the lengths necessary to accomplish the work.

2.2 FINISH

A. Broom finish perpendicular to direction of traffic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Place granular fill, compact and level, under walks and equipment pads.

3.2 INSTALLATION

A. Where walks run along parking areas, turn concrete down to form curb.

B. Place joint fillers every 30' in straight runs of walks, at right angle turns, and wherever the concrete butts vertical surfaces.

C. Tool transverse joints at 5' intervals unless otherwise detailed on the drawings. Joints shall be 1/4 the depth of the slab and 1/8" to 1/4" wide. Tool a 3/4" radius on edges of joints and on the sides of all walks.

D. When the concrete has hardened enough to bear a man's weight without imprint, float the concrete until its surface is porous and open. Broom lightly from side to side, keeping scoring lines straight and approximately 1/16" deep.

3.3 PROTECTION

A. Caution truck drivers and equipment operators to prevent damage. Replace any damaged walks or pads.

END OF SECTION

SECTION 32 13 16

PAVEMENT AND CURBS

PART 1 - GENERAL

1.1 GENERAL

A. This Section includes, but is not limited to providing asphalt and concrete paving and surfacing, and concrete curbs and gutters.

B. The work includes furnishing and installing paving subbase, base and final subgrade preparation and fine grading normally incidental to paving operations.

C. The work includes patching and/or repairing road affected by construction activities.

1.2 QUALITY ASSURANCE

A. Testing of pavements shall be done by a soil testing laboratory as required by the specifications. The Contractor shall correct any deficiencies in material makeup, strength or quantities revealed by testing.

B. Paving and curb construction and materials shall conform to the requirements of the GDOT Standard Specifications for Construction of Roads and Bridges, current edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials used shall meet the appropriate physical test requirements of the latest edition and/or revision of State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

B. Bituminous surfacing materials for replacement of Streets and Secondary State Highways of bituminous construction shall be hot mixed bituminous concrete, as specified in Section 424 of the GDOT Standard Specifications.

C. Paving base material shall be crushed stone meeting the requirements for granular fill described in Section 815 of GDOT Standard Specifications.

D. Drainage stone shall conform to requirements for drainage fill described in Section 806 of GDOT Standard Specifications.

E. Bituminous concrete materials.

1. Prime Coat: Bituminous Material for prime coat shall be as specified in Section 412 of GDOT Standard Specifications. Prime coat shall be Type MC-30 or MC-70 and applied at a rate of not less than 0.15 gallons or more than 0.30 gallons per square yard over the dense aggregate base.
2. Bituminous Concrete Binder Layer or leveling course: Binder layer of bituminous concrete conforming to Section 400 and Section 828 of the GDOT Standard Specifications. Apply over prime coat to a total compacted thickness of not less than 2½ inches.

3. Tack Coat: Bituminous tack coat shall be as specified in Section 413 of the GDOT Standard Specifications. Apply over binder layer at a rate of not less than 0.08 gallons and not more than 0.15 gallons per square yard of base course immediately preceding placement of the wearing surface.
4. Bituminous Concrete Wearing Surface: Wearing Surface of bituminous concrete shall conform to Section 424 of the GDOT Standard Specifications. Apply over binder layer after application of Tack Coat to a minimum compacted thickness of 1 inch. The total minimum combined total compacted thickness of the binder layer and wearing surface shall be not less than four inches.

F. Reinforced Concrete Pavement and Concrete Sidewalk

1. Reinforced Concrete pavement shall be in accordance with Section 430 of the GDOT Standard Specifications.
2. Class A structural requirements meeting requirements of Division 03 of these Specifications.
3. Welded wire reinforcing and reinforcing steel meeting requirements of Section on reinforcing steel.
4. Reinforced concrete pavement shall consist of Class A structural concrete with the thickness and reinforcing steel as shown on the Drawings. The concrete pavement shall be placed over a compacted dense graded aggregate crushed stone base with the thickness as shown on the Drawings.
5. The sidewalks shall consist of Class A structural concrete, 4 inches thick, reinforced with wire mesh placed over the previously prepared 3-inch thick compacted stone base. The shapes and sizes of the sidewalks shall be as indicated on the Drawings. The materials and methods of construction shall conform in all respects to the applicable sections of the Specifications, the Drawings or as directed by the Engineer.

G. Curb and Gutter

1. Asphaltic Concrete Curb shall be in accordance with Section 436 of the GDOT Standard Specification.
2. Precast Concrete Header Curb shall be in accordance with Section 438 of the GDOT Standard Specification.
3. Curb and gutter dimensions shall be as shown on the drawings.

PART 3 - EXECUTION

3.1 TRENCH REPAIR

A. Trench Surface Repaving on City and County Streets and Roads:

1. Bituminous paving Replacement: The cut edges of the existing paving surface shall be saw cut to a depth of at least 2-inch to straight lines for uniform appearance and clean surface at joints. The area between the cut edges of the paving shall be removed to a depth of 1 inch (minimum) below the bottom of the existing paving. All unstable material in the trench shall be removed and replaced with compacted dense graded aggregate added as needed to bring the subgrade surface to 1 inch below bottom of existing paving. No extra payment will be allowed for removal and replacement of unstable backfill.
2. The paving subgrade shall be compacted under the wheel of a loaded dual wheel vehicle until there is no observed settlement of the subgrade.
3. Prior to placing the paving material, the bottom and sides of surface to be paved shall be covered with a prime coat to insure adhesion.
4. Next, the bituminous paving shall be hot applied and rolled in accordance with the provisions of the State of Georgia Highway Department Standard Specifications for Highway Construction. Surface shall then be graded to one-quarter

inch above existing paving surface at edges and crowned to one-half inch above such surface at the center.

3.2 SUBGRADE PREPARATION

A. Before paving, the entire surface of the subgrade shall be plowed, harrowed, and mixed to a depth of 6 inches minimum. If stabilization stone is required by the Engineer, it shall be mixed into the subgrade at this time at the specified rate. After the material has been thoroughly mixed, the subgrade shall be brought to line and grade and compacted to 100 percent of the maximum laboratory dry density as determined by the Standard Proctor test. Surface of the finished subgrade shall be balded to a smooth and uniform texture.

B. The contractor shall protect subgrade from damage and maintain it in a smooth, compact, and rut-free condition until the base course has been placed.

3.3 PAVING SUBBASE COURSE

A. Paving subbase course shall be constructed of select surface soils previously stripped and stockpiled. Paving subbase shall be placed on prepared subgrade. Subbase shall be thoroughly mixed and blended and all materials removed that will interfere with fine grading. Subbase shall then be compacted to 100 percent of Standard Proctor for its full depth. The subbase surface shall conform to the established elevations with an acceptable tolerance of ½ inch above or below. All paving areas shall be free-draining without local depressions.

3.4 PAVING BASE COURSE

A. Paving base course shall be constructed of crushed stone and construction shall be done in accordance with Section 815 of the Georgia Department of Transportation Specifications.

3.5 BITUMINOUS PAVING

A. Bituminous paving shall be hot mix asphaltic concrete construction conforming to Sections 400 of the GDOT.

B. The job mix formula shall be submitted by the Contractor to the Engineer for his approval, and such approval does not relieve the Contractor of his responsibilities for adequacy and warranty of the paving.

C. Bituminous concrete pavement shall be applied with suitable mechanical spreaders so that the whole roadway or paved area shall have a true and uniform surface, and the pavement shall conform to the proper grade and cross section. Finish pavement shall have no depressions that detain runoff (birdbaths).

D. Set frames of drainage structures and miscellaneous castings to final grade in an approved manner.

E. All joints between new and existing asphalt or new asphalt and new or existing concrete surfaces shall be sealed with a bituminous joint sealer.

3.6 MISCELLANEOUS CONCRETE

A. Concrete paving and curbs shall be in accordance with Sections 430 of GDOT.

B. Curbing shall be constructed according to the details provided and at the locations shown on the drawings.

C. Concrete sidewalks shall be as located on the plans. All sidewalks damaged by construction activities shall be replaced from construction joint to construction joint.

3.7 REINFORCED CONCRETE SITE PAVEMENT

A. Reinforced concrete site pavement shall be placed over a granular structural fill subbase. The minimum compacted thickness of the subbase shall be 12 inches and it shall be granular structural fill as described elsewhere in the specifications.

B. Reinforced concrete site pavement shall be Class A structural concrete with a minimum thickness of 8 inches and reinforced with epoxy coated welded wire fabric conforming to Article 853 of the GDOT Standard Specifications. Welded wire fabric shall be a 4 inch by 4 inch grid (4 x 4 - (w4/w4)) weighing no less than 85 lbs. per square foot. As an alternate, (#4@12-inch epoxy coated reinforcing steel each way at center of slab is acceptable.

C. Control joints in the pavement shall be spaced at approximately 20 feet center to center maximum each way.

D. Expansion joints in the pavement shall be spaced at approximately 40 feet center to center maximum each way.

E. Concrete site pavement shall slope no less than 1/8 inch per foot to drain to grass areas and slope away from the site unless otherwise shown on the Drawings or directed by the Engineer.

F. Shop drawings showing the concrete pavement plan for the site with the location of control joints, expansion joints and isolation joints shall be submitted by the Contractor and approved by the Engineer prior to placing the pavement. The shop drawings shall also show the high point of elevations for the pavement and slopes for drainage.

3.8 STREET REPAVING

A. The tack coat shall be applied to the existing surface to insure adhesion between the underlying surface and the superimposed bituminous course.

B. A leveling course of bituminous surfacing shall be applied to fill the streets in low spots, correct ponding, and to fill in the area damaged by construction to the level of existing bituminous surface.

C. Finally, a one and one-half inch course of bituminous material shall be applied to the entire width of the street. The surface course shall be feathered out to a thickness of one-half inch at the front of the gutter. The point where feathering shall begin and the amount of feathering shall be controlled by the Engineer.

3.9 TEMPORARY PAVEMENT

A. The Contractor, upon completing the backfilling of the trenches in streets and the placing of the gravel base, may be required to construct a temporary pavement. Any trench not permanently paved within 36 hours shall require temporary pavement.

B. The temporary pavement shall be placed in one course and shall consist of 2 inch compacted thickness of bituminous concrete as directed by the Engineer. The pavement shall be maintained in good repair, flush with the existing pavement at all times, at the Contractor's expense.

C. The materials and methods of construction for temporary bituminous concrete pavement shall conform in all respects to the applicable subsections of Division 400 of the GDOT Standard Specifications.

3.10 PROTECTION

A. Immediately after placement, protect pavement from damage until surface is sufficiently hardened for traffic.

3.11 SURFACE MAINTENANCE

A. Until the expiration of the guarantee period, the Contractor shall maintain surfacing placed under this Contract and shall promptly correct all defects such as cracks, depressions, and holes that occur. At all times, the surfacing shall be kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by the contractor, the Contractor shall remove all bituminous concrete and base course as is necessary to properly correct the defect. The Contractor shall replace the base course and bituminous concrete in accordance with the requirements of these specifications.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.1 SCOPE

A. This Section includes the following:

1. Galvanized-steel chain link fabric.

2. Galvanized-steel framework.

B. Related Sections include but are not necessarily limited to:

1. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

2. Section 013300 – Submittals.

3. Section 033000 – Cast-in-Place Concrete, for concrete for post footings.

1.2 SUBMITTALS

A. General: Submit the following according to Section 013300 – Submittals.

B. Product data in the form of manufacturer's technical data, specifications and installation instructions for fence and gate posts, fabric, gates and accessories.

C. Shop drawings showing location of fence, gates, each post and details of post installation, extension arms, gate swing, hardware and accessories.

1.3 QUALITY ASSURANCE

A. Installer Qualification: Engage an experienced Installer who has at least three years' experience and has completed at least five chain link fence projects with same material and of similar scope to that indicated for the Project with a successful construction record of in-service performance.

B. Single-Source Responsibility: Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

PART 2 – PRODUCTS

2.1 FABRIC

A. Selvage: As indicated.

B. Steel Chain-Link Fence Fabric: Fabricated in one-piece widths for fencing 12-feet and less in height to comply with Chain Link Fence Manufacturers Institute (CLMFI) "Product Manual" and with requirements indicated below:

1. Mesh and Wire Size: 2-inch mesh, 0.148-inch diameter (9 gage).

2. Coating: ASTM A 817, Type 2, Class 1, zinc-coated (galvanized) applied after weaving.

2.2 FRAMING

A. Type I Round Posts: Standard weight (schedule 40) galvanized-steel pipe conforming to ASTM F 1083, according to heavy industrial requirements of ASTM F 669, Group IA, with minimum yield strength of 25,000 psi, not less than 1.8 oz. of zinc per sq. ft. Type A coating inside and outside according to ASTM F 1234, as determined by ASTM A 90 and weights per foot as follows:

Actual OD	Weight (lb/ft)	NPS Size
1.315	1.68	1
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2-1/2
3.500	7.58	3
4.000	9.11	3-1/2
6.625	8.97	6
8.625	28.55	8

B. Top Rail: Manufacturer's longest lengths (17-feet to 21-feet) with swedged-end or expansion-type coupling, approximately 6-inches long for joining. Provide rail ends or other means for attaching top rail securely to each gate corner, pull and end post.

1. Round Steel: 1.660-inch OD Type I or II steel pipe.

C. Steel posts for fabric heights up to 6-feet:

1. Round Line or Intermediate Posts: 1.90-inch OD Type I steel pipe.

2. Round End, Corner and Pull Posts: 2.375-inch OD Type I steel pipe.

D. Swing Gate Posts: Furnish posts to support single gate leaf or one leaf of a double-gate installation, according to ASTM F 900, sized as follows for steel and aluminum pipe posts:

1. Steel posts for fabric height of 6-feet or less and gate leaf width:

a. Up to and including 4-feet: 2.375-inch OD pipe weighing at least 3.11 lb per ft.

b. Over 4-feet to 10-feet: 2.875-inch OD pipe weighing at least 4.64 lb per ft.

2.3 FITTINGS AND ACCESSORIES

A. Material: Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel to suit manufacturer's standards.

1. Steel and Iron: Unless specified otherwise, hot-dip galvanized pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. zinc per sq. ft. as determined by ASTM A90.

B. Post and line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

C. Post Brace Assembly: Manufacturer's standard adjustable brace. Use material specified below for brace and truss to line posts with 3/8-inch-diameter rod and adjustable tightener. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.

1. Round Steel: 1.660-inch OD Type I or II steel pipe.

D. Bottom and Center Rail: Same material as top rail. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.

E. Tension or Stretcher Bars: hot-dip galvanized steel with a minimum length 2-inches less than the full height of fabric, a minimum cross section of 3/16-inch by 3/4-inch and a minimum or 1.2 oz. of zinc coating per sq. ft. Provide one bar for each gate and end post and two for each corner and pull post, except where fabric is integrally woven into the post.

F. Tension and Brace Bands: 3/4-inch-wide minimum hot-dip galvanized steel with a minimum of 1.2 oz. of zinc per sq. ft.

1. Tension Bands: 0.074-inch thick (14 gage) minimum.

2. Brace Bands: 0.105-inch thick (12 gage) minimum.

G. Tension Wire: 0.177-inch diameter metallic-coated steel marcelled tension wire confirming to ASTM A 824 with finish to match fabric.

1. Coating Type II zinc in the following class as determined by ASTM A90.

a. Class 1, with a minimum coating weight of 0.80 oz. per sq. ft. of uncoated wire surface.

H. Tie Wires: 0.106-inch-diameter (12 gage) galvanized steel with a minimum or 0.80 oz. per sq. ft. of zinc coating according to ASTM A 641, Class 3 or 0.148-inch-diameter (9-gage) aluminum wire allow 1350-H1p or equal, to match fabric wire.

2.4 CONCRETE

A. Concrete: Provide concrete consisting of portland cement per ASTM C150, aggregates per ASTM C33 and potable water. Mix materials to obtain Class B concrete with a minimum 28-day compressive strength of 3000 psi in accordance with Section 033000 Cast-in-Place Concrete.

B. Packaged Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C387 with clean water to obtain a 2-inch to 3-inch slump.

2.5 GATES

A. Fabricate perimeter frames of gates from same material and finish as fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8-feet apart unless otherwise indicated.

1. Fabric: Same as for fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with tie wires.

2. Bracing: Install diagonal cross-bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.

3. Barbed Wire: Extend end members of gate frames 12-inches above top member and prepare to receive three strands of wire. Provide necessary clips for securing wire to extensions.

B. Swing Gates: Comply with ASTM F900.

1. Steel: Gates up to 8-feet wide:

a. Up to 6-Feet High: Fabricate perimeter frames of 1.660-inch minimum OD Type I or II steel pipe of 1-1/2-inch-square galvanized-steel tubing weighing 1.84 lb per sq. ft.

2. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.

b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.

c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.

d. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete and designed to engage a center drop rod or plunger bar. Include a locking device and padlock eyes as an integral part of the latch, permitting both gates to be locked with a single padlock.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install fence to comply with STM F567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil. Unless otherwise indicated on Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than four times the largest cross section of post. Unless otherwise indicated, excavate hole depths approximately 3-inches lower than post bottom, with bottom of posts set not less than 36-inches below finish grade surface.

C. Setting Posts: Center and align posts in holes 3-inched above bottom of excavation. Space a maximum of 10-feet o.c., unless otherwise indicated.

1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.

a. Unless otherwise indicated, extend concrete footings 2-inches above grade and trowel to a crown to shed water.

D. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

E. Center Rails: Install center rails in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary.

F. Brace Assemblies: Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Bottom Tension Wire: Install tension wire within 6–inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11 gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24-inches o.c.

H. Top Tension Wire: Install tension wire through post cap loops before stretching fabric. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11 gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24-inches o.c.

I. Fabric: Leave approximately 2-inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework to that fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: thread through fabric and secure to end, corner, pull and gate posts with tension bands spaced not over 15-inches o.c.

K. Tie Wires: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.

1. Maximum spacing: Tie fabric to line posts 12-inches o.c. and to rails and braces 24-inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.

3.2 GATE INSTALLATION

A. Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage unless otherwise shown on the Drawings. Minimum anchorage shall include two anchorages, one adjacent to the road and the other at the furthest extent of the gate when open. Each anchorage shall be a drilled pier 3-feet in diameter and 3-feet in depth and shall include a reinforcement cage consisting of #4 bars circumferentially at 10-inches on center and vertically around the perimeter at 10-inches on center. Gate support structure shall be securely anchored to concrete anchorages. All gate hardware shall be 316 Stainless Steel. Adjust hardware for smooth operation and lubricate where necessary. Install gates according to manufacturer's instructions, plumb, level and secure.

END OF SECTION

SECTION 33 01 30

WASTEWATER FLOW CONTROL

PART 1 - GENERAL

1.1 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of wastewater flow control; plugging and blocking; pumping and bypassing; flow control precautions; and any other similar, incidental, or appurtenant flow control operation which may be necessary to properly complete the Work as shown on the Drawings and Specified herein.

B. The Contractor shall provide all services, labor, materials, and equipment required for all flow control and related operations necessary or convenient to the Contractor for furnishing a complete Work as shown on the Plans or specified in these Specifications.

1.2 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:

1. The design, installation, and operation of the wastewater flow control system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor that can demonstrate to the Engineer that the vendor specializes in the design and operation of wastewater flow control systems. The vendor shall provide at least three (3) references of projects of a similar size and complexity as this Project, which were successfully performed by the vendor's firm within the past three (3) years. The references shall include the name of the agency, the name of the project, the date of the project, and the agency contact (telephone, fax, and e-mail). The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
2. A general description of the proposed Wastewater Flow Control to include the make and model of temporary bypass pumps, the certified noise levels of the pumps and generator, the means used to maintain and operate the bypass pumps, and a written statement that all bypass pumping shall comply with the requirements of these Specifications.
3. During the course of the project, the detailed, work-specific Wastewater Control Plan utilizing multiple pumps, or a single pump greater than four (4) inches discharge, shall be submitted to the Engineer at least ten (10) days before required. This plan shall outline all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. This plan shall be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required to insure adequate wastewater control. The plan shall also include details of protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Specifications. No construction shall begin until all provisions and requirements have been reviewed and accepted by the Engineer.
4. The Contractor shall submit two (2) copies of the wastewater control plan for each sewer bypass set-up with sufficient detail including the following:
    a. Staging areas for pumps.
    b. Sewer plugging method and types of plugs.

c. Number, size, material, location, and method of installation of suction piping.
d. Bypass pump sizes, capacity, number of each size to be on the site of the Work and power requirements.
e. Calculations of static lift, friction losses, and flow velocity (pump curves) showing pump-operating range.
f. Standby power generator size and location.
g. Downstream piping and discharge plan.
h. Method of protecting discharge manholes or structures from erosion and damage.
i. Thrust and restraint block sizes and locations.
j. Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill where required.
k. Certified decibel levels of individual pumps, the combined decibel level if multiple pumps will be operated simultaneously, and the method of noise control for each pump and/or generator.
l. Any temporary pipe supports, including rollers and elevated rollers, as well as anchoring required.
m. Design plans and computations for access to bypass pumping locations.
n. Calculations for selection of bypass pumping pipe size.
o. Schedule for installation of and maintenance of bypass pumping lines.
p. Plan indicating selection location of bypass pumping line locations.
q. The Plan shall indicate the means by which flows from laterals are provided for either by plugging, containing, or subsidiary pumping. Building laterals shall not be disconnected or plugged overnight. Plugging of laterals is only allowed from 9 a.m. until 5 p.m. of the same day.

5. All proposed wastewater flow control arrangements, including flow bypass and/or diversion plans, shall indicate or show the location and position, in detail if necessary, any special features where pipes or hoses cross roadways, including intersections, such as temporary trenches, support bridges, ramp-overs, etc.
6. All proposed wastewater flow control arrangements, including wastewater flow bypass and/or diversion pumping plans for sewers, shall also include an emergency response plan to be followed in the event of a failure of the wastewater flow control system. The Contractor shall provide names and phone numbers for twenty-four (24) hour emergency contact.
7. The Contractor shall notify the Engineer twenty-four (24) hours prior to commencing actual wastewater flow control operations. The Contractor's Wastewater Flow Control Plan shall be approved by the Engineer before the Contractor shall be allowed to commence wastewater flow control work.

1.3 GENERAL

A. The objective of wastewater flow control is to:

1. Maintain an efficient and uninterupted level of service to wastewater collection system users while maintenance or construction operations (including rehabilitation, repair, replacement, or connection of newly constructed facilities) are facilitated on the segment or segments being bypassed and/or from which flow is being diverted, within the wastewater collection system.
2. Ensure that all levels of wastewater flow are continuously and effectively handled around the segment or segments of sewer being bypassed and/or from which flow is being diverted by:
   a. Ensuring that bypass and diversion pumps are adequately fueled, lubricated, and maintained.

b. Ensuring backup spare parts are expeditiously applied to the flow bypass and/or diversion pumping system in the event of component breakdown.

c. Ensuring that an emergency backup plan is smoothly implemented in the event of system failure.

d. Preventing backup, spillage, flooding, or overflow onto streets, yards, and unpaved areas or into buildings; adjacent ditches; storm sewers; and waterways; while flow bypass or diversion pumping takes place and ensuring that installation, startup, and subsequent disassembly of the flow bypass and diversion pumping system is smoothly transitioned.

PART 2 - PRODUCTS

2.1 PIPE FOR FLOW DIVERSION

A. Ductile Iron Pipe: Ductile iron pipe as specified in Section 33 3120 Ductile Iron Pipe and Fittings is acceptable for use for flow diversion during construction.

B. Polyethylene Pipe: Polyethylene material shall comply with the requirements for Type III polyethylene, C-5 and P-34 as tabulated in ASTM D1248 and have the Plastic Pipe Institute recommended designation PE3406. The material shall also have an average specific base resin density of between 0.94 g/cc and 0.955 g/cc (ASTM D1505). Pipe made from these resins must have a long term strength (50 years) rating of 1,250 psi or more per hydrostatic design basis categories of ASTM D2837. The polyethylene resin shall contain antioxidants and be stabilized against ultraviolet degradation to provide protection during processing and subsequent weather exposure. The polyethylene resin shall have an environmental stress crack resistance, condition C as shown in ASTM D1693, to be greater that five-hundred (500) hours, twenty (20) percent failure. All pipe shall be made from virgin quality material. No rework compound, except that obtained from the manufacturer's own production of the same formulation shall be used. The polyethylene resin shall have an average melt flow index, condition E as shown in ASTM D1238, not in excess of 0.25 g/10 min. Pipe shall be homogeneous throughout, and free of visible cracks, holes, foreign material, blisters, or other deleterious faults. Diameters and wall thickness shall be measured in accordance with the requirements of ASTM D2122. Pipe joining will be done by thermal butt fusion method in accordance with the requirements of ASTM D657.

2.2 PUMPING EQUIPMENT

A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered, provided they meet all specified sound level requirements. If electric pumps are used, the combined generator/pump system shall meet the specified sound level requirements. All pumps used shall be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. Unless specified otherwise in these Specifications or approved by the Engineer, all pumps (and generators if used) shall be fully sound attenuated and shall produce a noise level of sixty-five (65) dBA or less at a distance of twenty-three (23) feet. Ensure that pumps are equipped to meet the requirements of local noise ordinances.

C. The Contractor shall provide the necessary stop/start controls for each pump.

D. The Contractor shall include one stand-by pump of each size to be maintained on site of the Work. Back-up pumps shall be on-line, isolated from the primary system by a valve.

E. The Contractor shall design all piping, joints, and accessories to withstand twice the maximum system pressure or fifty (50) psi, whichever is greater. The back-up pump, appropriate piping, fuel, lubrication, and spare parts shall be incorporated into the bypass arrangement at the site of the Work, ready for use in case of breakdown. A bypass "drill" shall be carried out by the Engineer before the bypass arrangement is accepted on all sewers greater than twelve (12) inches in diameter, at no cost to the County. The drill shall demonstrate the incorporation of all standby equipment to handle flows when the main pump set is switched off. The Engineer's instructions following the drill shall be adhered to in full at no cost to the County.

F. No more than two (2) pump discharge hoses shall be used for wastewater flow control over a length of the line segment(s). If the flow exceeds the capacity of (2) "hoses" then rigid piping shall be used. The rigid piping shall consist of Ductile Iron Pipe, HDPE, or steel pipes with suitable pressure rated couplings to withstand twice the maximum system pressure or fifty (50) psi, whichever is greater.

G. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

2.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Bypass pumping systems shall have sufficient capacity to pump peak flows in the pipes being bypassed (flows in the existing sewers can increase dramatically during periods of wet weather). The Contractor shall provide all pipeline plugs, pumps of adequate size to handle wet weather peak flows, and temporary discharge piping to ensure that the total flow of the mainline is safely diverted around the section to be repaired. Wastewater flow control system will be required to be operated twenty-four (24) hours per day.
2. Capacity of the bypass pumps shall match the capacity of the dry pit submersible pumps to be installed in the drywell. The water level in the wetwell shall not affect flow depth of the influent sewer.
3. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One (1) standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
4. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One (1) standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
5. The wastewater flow control system shall be capable of bypassing the flow around the work area and of releasing any amount of flow, up to full available flow, into the work area as necessary for satisfactory performance of the Work.
6. The Contractor shall make all arrangements for bypass pumping during the time when the mainline is shut down for any reason. The wastewater flow control system shall overcome any existing force main pressure on discharge.

B. Performance Requirements:

1. It is essential to the operation of the existing wastewater system that there is no interruption in the flow of wastewater throughout the duration of the project. To this end, the Contractor shall provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the wastewater flow before it reaches the point where it would

interfere with the Work, carry it past the Work, and return it to the existing sewer downstream of the work.

2. The design, installation, and operation of the wastewater flow control system shall be the Contractor's responsibility. The wastewater flow control system shall be the Contractor's responsibility.
3. The Contractor shall provide all necessary means to safely convey the wastewater past the work area. The contractor will not be permitted to stop or impede the mainline flows under any circumstances.
4. The Contractor shall maintain wastewater flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage and flooding.
5. The Contractor shall protect water resources, wetlands, and other natural resources.

PART 3 - EXECUTION

3.1 PLANNING

A. The Contractor shall be solely responsible for planning and executing all wastewater flow control operations. The Contractor shall be entirely liable for damages to private or public property that may result from its operations and for all cleanup, disinfection, damages, and resultant fines in the event of a spillage, flooding, or overflow.

3.2 GENERAL

A. All materials used for wastewater flow control shall be pre-approved by the Engineer prior to commencing wastewater flow control activities.

B. The Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate its bypass pipelines to minimize any disturbances to existing utilities and shall obtain approval of the pipeline locations from the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

C. During all wastewater flow control operations, the Contractor shall protect mainlines, manholes, and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to mainlines, manholes, and all local sewer lines caused by human or mechanical failure.

D. All pipe materials utilized in wastewater flow diversion during construction shall be in good condition, and free of defects, and leaks. Any defective material shall be replaced by the Contractor at no cost to the County. Upon completion of the job, pipe materials shall be removed from the site.

E. The Contractor shall complete all wastewater flow control activities with the minimum sound level compatible with accepted industry standards for sound attenuated temporary pumping systems.

F. When pumps are operating, an experienced bypass/diversion pump maintenance operator, mechanic, and/or qualified person shall continuously be on site to monitor the operation of the entire bypass/diversion system. The operator, mechanic, and/or assistant shall comprehensively, methodically, and continuously:
   1. Adjust pump speed as appropriate so as not to adversely impact upstream or downstream flow condition levels.

2. Check that the effectiveness and security of bulkheads, dams, diaphragms, plugs, valves, weirs, and all other flow control devices are working effectively and according to plan.
3. Check the integrity of hoses and couplings along the entire bypass/diversion system.
4. Monitor fuel tanks and top up as appropriate.
5. Monitor lubrication levels and top up as necessary.
6. Facilitate minor repairs as required.
7. Report on potential problems arising.
8. Inspect bypass-pumping system at least hourly to ensure that the system is working correctly.
9. Maintain adequate supply of spare parts on site as required.

3.3 PUMPING AND BYPASSING

A. Wastewater shall be pumped directly into the existing pump station force main, downstream of the construction. The Contractor shall be responsible for keeping the pumps running continuously twenty four (24) hours a day if required, until the bypass operation is no longer required. The Contractor shall have standby pumps at all times.

B. Pumps and equipment shall be continuously monitored by a maintenance person capable of starting, stopping, refueling, and maintaining these pumps during the bypassing operations. If pumping is required on a twenty four (24) hour basis, engines shall be equipped in a manner to keep noise to a minimum. Provide pumps with sound enclosures or other sound attenuation methods to meet the requirements of City of Sandy Springs noise ordinances.

C. An auto-dialer system shall be incorporated into the pumping system where it can be programmed to store up to four telephone numbers.

3.4 FLOW CONTROL PRECAUTIONS

A. The Contractor shall take appropriate steps to ensure that all pumps, piping, and hoses that carry raw wastewater are protected from traffic.

B. In the event, during any form of "Wastewater Flow Control," that raw wastewater is spilled, discharged, leaked, or otherwise deposited in the open environment, due to the Contractor's work, the Contractor shall be responsible for any cleanup of solids and stabilization of the area affected. This work shall be performed at the Contractor's expense with no additional cost to the County. The Contractor shall also be responsible for notifying the sewer system maintenance personnel and complying with any and all regulatory requirements for cleaning up the spill at no additional cost to the County.

C. During wastewater flow control operations, the Contractor shall take proper precautions to prevent damage to existing sanitary sewer facilities, flooding, or damage to public or private property.

D. The Contractor shall make repairs or replacements or rebuild such damaged section or sections of existing sewers, as directed by the Engineer. All such repairs, replacements, and rebuilding shall be paid for by the Contractor.

E. The Contractor shall make such provisions as are necessary for handling all flows in existing sewers, connections, and manholes by pipes, flumes, or by other approved methods at all times, when its operations would, in any way, interfere with normal functioning of those facilities.

F. All operations shall be performed by the Contractor in strict accordance with OSHA and any applicable local safety requirements. Particular attention is directed to safety regulations for excavations and entering confined spaces.

END OF SECTION

SECTION 33 05 16

PRECAST CONCRETE UTILITY VAULT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for precast concrete utility vaults.

B. Related Sections include the following:

1. Division 31 Earthwork Sections for excavation requirements..

1.3 DEFINITIONS / STANDARDS

A. The following are industry abbreviations for metal materials:

1. DIP: Ductile iron pipe.

2. Buried piping shall be of the bell and spigot or mechanical joint type as required by material and application.

3. Non-buried piping shall have flanged ends, unless otherwise noted on the Drawings.

4. Use Mechanical Joint Fitting Restraining Device for plain end piping connections to fittings, valves, etc.

1.4 SUBMITTALS

A. Product Data:

1. Concrete vaults and accessories.

B. Shop Drawings:

1. Concrete vaults including hatches, frames and covers, ladders, and drains.

2. Design calculations by a structural engineer registered in the State of Georgia (for information only).

3. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data,” include the following:

4. Hatches for concrete vaults.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated.

B. Comply with regulatory requirements of local, state and federal agencies having jurisdiction.

C. Coordinate this work with that required by other sections for timely execution.

D. It shall be the Contractor's responsibility to ensure that all necessary materials are furnished to them and that those found to be defective in manufacture are replaced at no extra cost to the Owner. Materials damaged in handling after being delivered by the manufacturer shall be replaced at the Contractor's own expense. If installed material is found to be defective before the final acceptance of the work, the cost of both the material and labor needed to replace it shall not be passed on to the Owner.

E. Furnish all material, equipment, tools, and labor in connection with the precast concrete utility vault, complete and in accordance with the drawings and these specifications.

PART 2 - GENERAL

2.1 CONCRETE VAULTS

A. Concrete vaults shall be rectangular precast concrete, of the dimensions and specifications noted on the Drawings and Division 03 of these specifications.

B. Precast vaults shall be designed for AASHTO H-20 traffic loading. Design calculations stamped and signed by a structural engineer registered in the State of Georgia affirming the H-20 traffic loading shall accompany the submittal.

C. Precast section joints shall be mortared or grouted; joined with AASHTO M-198-75 preformed flexible butyl type joint sealant. Joints should be water tight

D. Manufacturer / Model:

1. Hamilton-Kent “Kent-Seal No. 2”,
2. K.T. Snyder Company “rub ‘r-Nek”,
3. Press Seal Gasket “E-Z Stik”, or
4. Approved equal.

E. Manufacturer:

5. Foley Concrete Products
6. Tindall
7. Approved equal.

2.2 ACCESSORIES

A. Hatches

1. Channel frame shall be ¼-inch thick extruded aluminum with a mill finish, incorporating a continuous concrete anchor. A 1-1/2 inch drainage coupling shall be located in the front left corner of the channel frame. A bituminous coating shall be applied to the frame exterior where it will come into contact with concrete. The entire frame must be supported by a full bed of Class A concrete.

2. The door panel(s) shall be 1/4 inch aluminum diamond plate, reinforced to withstand an H-20 live load with a maximum allowable deflection of 1/150 of the span and shall not protrude into the channel frame when in the open position.

3. Doors shall open to 90 degrees and automatically lock with a Type 316 stainless steel hold open arm with an aluminum release handle. For ease of operation, the door hold open arm shall incorporate an enclosed stainless steel compression spring assist.

4. Doors shall close flush with the frame.

5. Hinges and all fastening hardware shall be Type 316 stainless steel.

6. Unit shall lock with a Type 316 stainless steel slam lock with removable key and have a non-corrosive handle.

7. Unit shall carry a lifetime guarantee against defects in material and/or workmanship.

8. Manufacturer:

   a. Bilco

   b. Halliday

   c. USF Fabrications

   d. Approved equal.

B. Ladder/Steps:

1. Ladder/steps shall be steel encased in copolymer polypropylene plastic (or equal), “Press Fit” type, have an overall width of 12 inches, and spaced at 12 inches.

2. Manufacturer:

   a. M.A. Industries, or

   b. Approved equal.

C. Pipe Penetrations shall be water tight and sealed in the vault wall opening with flexible and/or rigid connections. At least one pipe penetration shall be a rigid connection.

D. Flexible connections shall be provided using resilient connectors meeting the requirements of ASTM C-923. Resilient connectors shall be compression type cast integrally into the vault wall.

1. Manufacturer:

a. A-Lok Products, Inc., Tullytown, PA, or

b. Approved equal.

E. Rigid Connections shall be provided using a thrust collar wall pipe. Thrust collar wall pipes shall be cast integrally into the vault wall. Thrust collar wall pipes shall meet the requirements of ductile iron flanged piping, as specified herein, unless otherwise specified.

1. Manufacturer:

a. U.S. Pipe,

b. American Ductile Iron Pipe, or

c. Approved equal.

F. Vault Drainage:

1. Vault drainage shall be as noted on the Drawings and according to the following.

2. Drain pipe shall be schedule 80 PVC and penetrate the wall at floor level. Slope of drain line shall be in accordance with local plumbing codes. A varmint screen shall be installed on the drain line inside the vault for ease of maintenance. A flap valve shall be installed on the drain line discharge.

3. Vault electrical, if any, shall be in accordance with the requirements of Division 26 and the Drawings.

G. Vault Piping:

1. Piping shall be supported with column type pipe saddle supports, concrete block, or other Engineer approved method.

2. Column type pipe saddle supports shall be stanchion type with vertical adjustability and U-bolt attachment to pipe. The stanchion shall be properly sized to carry the pipe load. The saddle assembly and base shall be cast iron or carbon steel.

3. Manufacturer:

a. Grinnell Corporation, Providence, RI, or

b. Approved equal.

4. Concrete pipe supports shall be full or half-size, solid CMU placed under pipe, valves, meters, etc. flanges or under flanged base bends. Flanged base bends shall be bolted to the concrete pipe support.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.2 CONCRETE VAULT INSTALLATION

A. Dewater sufficiently to maintain the ground water level at or below the bottom of the vault foundation prior to and during placement of the foundation.

B. Obtain an adequate foundation for the structure by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected lines or as directed by the Engineer. Wherever water is encountered at the site, place all cast-in-place bases or monolithic structures on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.

C. When the foundation subgrade has been prepared and is approved by the Engineer, carefully construct the foundation for precast and monolithic structures to the line and grade required by the Drawings. The foundation shall be well graded granular material. In no case shall the vault be supported directly on rock.

D. Vault foundation shall be constructed such that the vault is fully and uniformly supported in true alignment according to the Drawings and as site conditions allow. Make sure that all entering pipe can be installed at proper grade.

E. Thoroughly wet and the completely fill all lift holes and all interior joints between precast elements with non-shrink grout. Smooth them inside to ensure water tightness.

F. Carefully set the vault top at the required elevation, and properly bond it to the vault with cement grout or rubber sealant. Wherever vaults are constructed in paved areas, tilt the vault top so as to conform to the exact slope and grade of the existing adjacent pavement.

G. Place backfill by hand around the vault and to a distance of at least one pipe length into each trench, and tamp with selected material up to an elevation of 12 inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

H. Install pipe supports in accordance with the manufacturer's recommendations. Supports shall be installed in the locations shown on the Drawings. In cases where supports are not shown, supports shall be furnished and installed at appropriate locations to ensure adequate support of piping, valves, etc. Supports shall be installed in locations that ease removal and re-alignment of valves, meters, etc.

I. After the vault had been adjusted to the proper grade, it shall be visually inspected by the Contractor in the presence of the Engineer. Any defects noted shall be corrected by the Contractor until the work is found satisfactory to the Engineer. In addition, at the Owner's or Engineer's request, the Contractor may be required within one year to visually inspect any vault(s) that were adjusted. Any work that has become defective shall be redone by the Contractor at no additional expense to the Owner.

J. Vault shall have positive drainage when site conditions allow. When positive drainage is not available, a sump pump shall be installed.

3.3 HATCH DRAINAGE

A. Precast concrete vault manufacturer shall extend hatch frame drains through the concrete to the exterior face of the vault, a minimum of 6” below finished grade.

B. Contractor shall place 5 cubic feet of #57 stone against edge of concrete vault, with the top of the drywell flush with the top of the hatch frame drain. Drywells shall be constructed for each hatch drain.

END OF SECTION

SECTION 33 12 16

VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following general-duty valves:
1. Gray-iron swing check valves.
2. Cast-iron plug valves.
3. Resilient-seated, cast-iron, eccentric plug valves.
4. Ball valves.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated, include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

B. Exceptions: Domestic hot- and cold-water and sanitary waste piping valves unless referenced.

C. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

D. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.

3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2(DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2(DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:
1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8(DN 200) and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6(DN 150) and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

Extended Valve Stems: On insulated valves.

G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

H. Valve Grooved Ends: AWWA C606.

I. Solder Joint: With sockets according to ASME B16.18.

6. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

J. Threaded: With threads according to ASME B1.20.1.

K. Valve Bypass and Drain Connections: MSS SP-45.

2.3 GRAY-IRON SWING CHECK VALVES

A. Swing check valves shall meet the requirements of AWWA C508 supplied with a lever and weight controlled valve and dampener.

B. Flanges: ANSI B16.1 Class 125

C. Manufacturers:

1. Gray-Iron Swing Check Valves with Composition to Metal Seats:
   a. Kennedy Valve Co.
   b. GA Industries.
   c. Henry Pratt Co..
   d. Approved equal.

D. Gray-Iron Swing Check Valves, General: MSS SP-71.

E. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.

F. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.

2.4 CAST-IRON PLUG VALVES

A. Manufacturers:

a. Non-lubricated-Type, Cast-Iron Plug Valves:
b. General Signal; DeZurik Unit.
c. Grinnell Corporation.
d. Mueller Flow Technologies.
e. Tyco International, Ltd.; Tyco Valves & Controls.
f. Wheatley Gaso, Inc.
g. Xomox Corporation.
h. Approved equal.

B. Cast-Iron Plug Valves, General: MSS SP-78.

C. Class 125 or 150, non-lubricated-type, cast-iron plug valves.

D. Class 250, non-lubricated-type, cast-iron plug valves.

2.5 RESILIENT-SEATED, CAST-IRON, ECCENTRIC PLUG VALVES

A. Manufacturers:

1. General Signal; DeZurik Unit.
2. Milliken Valve Company.
3. Olson Technologies; Homestead Div.
4. Pratt, Henry Company.
5. Val-Matic Valve & Mfg. Corp.

6. Approved equal.

B. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, NPS 2-1/2(DN 65) and Smaller: Design similar to MSS SP-108, and rated for 175-psig minimum CWP.
1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

C. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, NPS 3(DN 80) and Larger: MSS SP-108, and rated for 175-psig minimum CWP.
1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

2.6 BALL VALVES

A. Manufacturers:
1. Henry Pratt Co., Aurora, IL.
2. Approved equal.

B. Provisions:
1. Rubber-seated ball valves, shaft or trunnion-mounted. All ball valves product of one manufacturer.
2. Conditions of service, valve controls, materials, workmanship, and testing as specified.
3. Conform to AWWA C507 except as herein modified.
4. Body: Cast iron or ductile iron flanged ANSI B16.1 Class 150 with support legs or pads.
5. Plug: Cast iron or ductile iron, with full unobstructed circular port diameter.
6. Seats: single or double seated, mounted on body plug, resilient seat to be Buna-N or other synthetic elastomer resistant to oil and grease. Wearing surfaces to be 316 stainless steel. Droptight shutoff in both directions.
7. Bearings: Bronze sleeve type, zinc free, permanently lubricated. Provide two-way thrust bearings.
8. Shafts: Stainless steel, chrome moly steel or monel, keyed or pin connected to plug.
9. Seals: O-ring bearing seals and O-ring or split-V-type packing shaft seal.
10. Cast in raised letters on body, size of opening, name of maker, year of manufacturer, and working pressure for which designed.

C. Manual Operators:
1. Operator capable of valve operation at rated pressure with 80 lb. Pull on actuator. Operator to be self-locking.
2. Valves 6-inches and smaller, lever operator, 18-inches maximum length.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

D. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

E. Examine threads on valve and mating pipe for form and cleanliness.

F. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

G. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4(DN 100) and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.
2. Plug Valves: In horizontal or vertical position between flanges. For eccentric plug valves in vertical position, plug must close valve on top.

3.4 JOINT CONSTRUCTION

A. Flanged Joints: Assemble joints with gasket, lubricant, and bolts according to manufacturer's written instructions.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 33 31 20

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all materials for and shall properly install, adjust and test, and place in continuous operation at the locations indicated or as directed, all push-on ductile iron pipe, all mechanical joint ductile iron pipe, all restrained joint ductile iron pipe, and all ductile iron fittings for the construction of the sewer lines as necessary for the proper completion of the work.

B. Wherever the work disturbs existing conditions or work already completed, the same shall be restored to its original condition in every detail. All such replacement and repair shall meet with the approval of the Engineer.

C. It is the Contractor's responsibility to furnish all materials and pipe and fittings required, and in conformance with all applicable codes.

D. It is the intent of this Contract to require an installation under this Item which is complete in every detail, whether or not indicated on the Drawings, or specified herein. Consequently, the Contractor shall be responsible for all details, devices, accessories, and special construction which may be necessary to properly furnish, install, adjust, test, and place in continuous and satisfactory operation, a complete installation.

PART 2 - PRODUCTS

2.1 PIPE COATING AND LINING

A. All ductile iron pipe and fittings buried underground or submerged shall have a standard bituminous outside coating conforming to ANSI A21.6 or A21.51. All exposed ductile iron pipe and fittings shall have an outside coating of universal primer. Unless noted otherwise, all ductile iron pipe used for water or wastewater shall have Protecto™ 401, a ceramic epoxy lining as manufactured by Induron Protective Coatings or approved equivalent.

B. Paint all steel sleeves, tapping sleeves, rods, nuts and washers, and couplings with Roster Laboratories, Inc., -Roskote Mastic No. A-939, or Koppers Company, Inc. Bitumastic Superservice Black or approved equivalent.

2.2 PUSH-ON PIPE AND FITTINGS

A. Provide all push-on ductile iron pipe manufactured in accordance with and meeting the latest requirements of AWWA C151/A21.51.

B. Provide all push-on fittings with body thickness and radii of curvature conforming to the latest AWWA C110 or AWWA C153/A21.53. Make design of fittings, whether long or short pattern, as indicated, noted or directed on the drawings.

2.3 MECHANICAL JOINT PIPE AND FITTINGS

A. Provide all mechanical joint ductile iron pipe barrels manufactured in accordance with the latest requirements of AWWA Standard C151/A21.51.

B. Make the mechanical joint herein specified for mechanical joint ductile iron pipe and fittings meet the requirements of AWWA Standard C111/A21.11.

C. Provide all mechanical joint fittings with body thickness, laying length and radii of curvature conforming to the latest AWWA Standard C110/A21.10 and joints in accordance with Section 11-2.3 of the latest AWWA Standard C111/A21.11, minimum Class 250 Ductile Iron in all sizes. Make design of fittings, whether long or short pattern, as indicated, noted or directed on the drawings. Make special fittings conform to dimensions and details as directed, indicated or noted on the drawings.

2.4 RESTRAINED JOINT PIPE AND FITTINGS

A. Provide all restrained joint push-on ductile iron pipe barrels manufactured in accordance with the latest requirements of the AWWA Standard C151/A21.51.

B. Provide restrained joint push-on pipe and fittings, American Cast Iron Pipe "Lock-Ring", U. S. Pipe TR-FLEX or equal.

C. Provide restrained joint fittings with body thickness, laying length and radii of curvature conforming to the latest AWWA Standard C110/A21.10 and joints in accordance with Section 11-2.3 of the latest AWWA Standard C111/A21.11, minimum Class 250 Ductile Iron in all sizes. Make design of fittings, whether long or short pattern, as indicated, noted or directed on the drawings. Make special fittings conform to dimensions and details as directed, indicated or noted on the drawings.

2.5 WALL THICKNESS

A. Ductile iron pipe used as gravity sewer line shall have the following minimum wall thickness unless otherwise specified. Ductile iron pipe used as force mains shall have the minimum wall thickness or be of the minimum class as specified on the drawings.

Pipe Diameter (inches)	Bedding Class	Maximum Depth of Cover	Pressure Class	Thickness Class	Minimum Thickness
10	B	45	350	50	.29
10	C	30	350	50	.29
12	B	40	350	50	.31
12	C	25	350	50	.31
12	B	50	350	51	.34
12	C	35	350	51	.34
14	B	40	350	50	.33
14	C	25	350	51	.33
16	B	35	350	50	.34
16	C	20	350	50	.34
16	B	40	350	51	.37
16	C	25	350	51	.37

PART 3 - EXECUTION

3.1 JOINING PIPES

A. Sufficient lubricant shall be furnished with each order of pipe to provide a thin coating on each spigot end. Lubricant shall have no deleterious effect on the rubber gasket. Lubricant shall be of such consistency that they can be easily applied to the pipe in either hot or cold weather and shall adhere to either wet or dry pipe. Only lubricant furnished with the pipe by the pipe manufacturer shall be used.

B. The gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto 401™ Joint Compound or approved equivalent. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

C. Transition joints between sewer pipes of different materials shall be accomplished by the use of adapters made especially for that purpose. Shop drawings must be submitted and approved by the Engineer prior to the use of any adapter for this purpose.

3.2 CUTTING PIPE

A. Wherever the pipe requires cutting to fit into the line, the work shall be done in a satisfactory manner so as to leave a smooth end at right angles to the axis of the pipe. When a piece of pipe is cut to fit into the line, no payment shall be made for the portion cut off and not used in the line. Joints on existing piping will be carefully cut and any breakage will be at the sole expense of the Contractor.

3.3 BUILT-IN PIPE AND FITTINGS

A. Where indicated on the Drawings, or directed, pipe and fittings shall be carefully built in, connected to, or supported on concrete or brick masonry.

3.4 ANCHORAGE

A. Where indicated on the drawings, or directed, plugs, caps, tees, and bends deflecting 22-1/2 degrees or more shall be provided with restrained joint fittings or two independent restraints, (i.e. megalug plus blocking or megalug plus rodding) as detailed on the drawings. 11-1/4 degree bends may be restrained with only one method. Payment for thrust blocks shall be included in the unit price bid for Ductile Iron Pipe and Fittings. Payment for concrete thrust blocking shall be paid for under the item titled Concrete.

3.5 TESTING

A. Pipes, fittings, and appurtenances on ductile iron pipe shall be laid in such a manner as to leave joints water-tight. Ductile iron pipe used as a force main shall be tested to the pressure specified on the plans but to a minimum of 150 PSI, as measured at the lowest elevation on the test section.

B. Tests shall be performed in the presence of the Engineer for force main testing. The Contractor shall furnish a pressure gauge for measuring the pressure on the line, shall provide a corporation cock in the line to attach gauge or pump connection, and shall provide plugs to seal taps after use in testing, and shall also furnish a suitable pump, pipe, and appliances, labor, fuel, and other appurtenances necessary to make these tests.

C. Each section of pipe shall be filled slowly with water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a pump connected to the pipe in the satisfactory manner. The Contractor will furnish all test water at a hydrant.

D. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, as directed by the Engineer, if necessary, at points of highest elevation, and afterward tightly plugged, all, at the Contractor's expense.

E. The test pressure shall be maintained for a minimum of two (2) hours to allow for thorough examination of leakage where necessary. The pipe line shall be made watertight under the test pressure.

F. No separate payment will be made for testing, but the cost thereof shall be included in the Lump Sum bid.

3.6 MARKING

A. Mark all ductile iron and ductile iron fittings in accordance with AWWA Standard C110/A21.10, Section 10-9, "Marking of Fittings". Mark all ductile iron pipes in accordance with requirements of Section 51-10, "Marking Pipe", of AWWA Standard C151/A21.51. Also include in marking the manufacturer's initials, year cast, and class letter or number. Paint mark number and weight conspicuously on each piece.

B. Furnish the Engineer with lists of all pieces of pipe and fittings in each shipment received. On lists indicate the serial or mark number, weight, class, size and description of each typical piece received.

3.7 INSPECTION

A. Furnish to the Engineer copies of the manufacturer's sworn certificate of inspection and testing of all ductile iron pipe and ductile iron fittings provided on the Work. All ductile iron pipe and cast iron fittings will be subject to inspection and approval by the Engineer after delivery of material to the site. Do not use broken, cracked, misshaped, imperfectly coated, unsatisfactory or otherwise damaged ductile iron pipe or cast iron fittings.

B. Such inspection by the Engineer does not relieve the Contractor of full responsibility for the material installed.

3.8 UNLOADING AND LAYING

A. Unload ductile iron pipe, fittings and accessories with hoists or by skidding. Under no circumstances are pipe to be dropped. Do not skid or roll pipe handled on skid ways against pipe already on the ground. Do not damage casting and linings; but, in the event should damage occur, make repairs or replacement to satisfaction of the Engineer.

B. Use proper, suitable tools and appliances for the safe and convenient handling and laying of the pipe and fittings. Take care to prevent the pipe coating from being damaged, particularly on the inside of the pipe and fittings.

C. Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling. Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded.

Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

D. Carefully examine all pipe and fittings for defects just before laying and lay no pipe or fitting which is known to be defective. In the event that defective pipe is discovered after having been laid, remove and replace with a sound pipe or fitting in a satisfactory manner at Contractor's expense.

E. Thoroughly clean all pipe and fittings before being laid. Plug open ends of pipe with an approved plug during construction.

3.9 TOUCH-UP AND REPAIR

A. Touch-up and repair work on pipe lining shall be performed using Protecto 401™ Joint Compound or approved equal in accordance with manufacturer's recommendations.

3.10 CLEAN-UP

B. A thorough clean-up shall be made before final acceptance and final payment for each project is made. All excess rock shall be removed, private and public property shall be restored to original condition and all excess pipe and fittings shall be removed.

3.11 GUARANTEE

A. The Contractor shall guarantee for a period of twelve (12) months from the date of Final Acceptance, all lines, appurtenances, trenches, and other disturbed surfaces.

B. The Contractor shall be responsible for repairs to any leaking pipe, fittings, etc. Should trenches settle, he shall promptly furnish and place fill to original grade. Should any leaks or trench settlement occur under the new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement.

END OF SECTION

SECTION 40 05 00

APPLICATION ENGINEERING SERVICES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The General Provisions of Section 40 90 00 shall apply to this section.

B. All work in this Section shall be the product of the Process Instrumentation and Control Supplier (PICS). Sub-suppliers and/or manufacturers may provide components, and/or services to the PICS, but the final product shall conform to this specification and shall be the sole responsibility of the PICS.

C. The PICS shall provide all applications programming and services required to achieve a fully integrated and operational system. The PICS shall coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications and with related existing equipment.

D. Auxiliary and accessory programming structures necessary for system operation or performance shall be included whether or not they are specified or shown on the Contract Drawings.

E. All equipment shall be controlled in full conformity with the Specifications, Drawings, engineering data, instructions and recommendations of the equipment manufacturer.

F. To facilitate the Owner's future operation and maintenance requirements, all programming and operator interface development shall utilize standards as agreed upon by the Owner and Engineer.

G. The PICS shall coordinate and schedule all testing procedures with the General Contractor.

H. See I/O List at the end of this section.

1.2 RELATED WORK

A. Refer to 40 95 13 - Process Control Panels.

B. Refer to 40 90 00 - Process Instrumentation & Control Supplier.

C. Refer to 40 91 00 -Instrumentation Devices

1.3 SUBMITTALS

A. Refer to Section 409000.

B. Submittals listed below shall be provided, as a minimum. Each submittal must be complete in order to be reviewed by the Engineer.

1. Preliminary Graphics Submittal

2. Process Control Description describing the operating sequence of the pumps including speed control, set points, alternation, etc. In general, the pumps will be operated to maintain a level (adjustable at HMI) in the wetwell.

3. Testing - Refer to Section 409000.

4. Training - Refer to Section 409000.

5. O&M Manuals - Refer to Section 409000.

1.4 SYSTEM DESCRIPTION

A. The PICS is responsible for providing all applications programming and configuration services to accomplish the control and monitoring functions described in the Specifications and Contract Drawings. The PICS shall provide all programming functions including the PLC and HMI. The PICS shall also provide all application programming and configuration services necessary to produce the HMI graphic displays, reports, trends, historical archive, etc. as described in the Specifications and Contract Drawings.

B. PICS shall develop and provide twelve (8) customized graphic displays for the 10" HMI touch screen located on the front of the Master Control Panel. The screens shall illustrate the entire pump station process control system. All graphic displays shall be designed by the PICS utilizing the HMI software and shall be approved by the Engineer/Owner. These displays shall be prepared and submitted in the shop drawings. The displays shall represent all process control systems and all associated equipment, pumps, valves, gates, feed systems, filters and auxiliary systems. The PICS shall establish a consistent process control philosophy, standard graphical layout and standard graphical symbolic representation for all displays. The PICS shall provide the following list of displays as a minimum:

- Pump Station Overview Indicating
  1. Pump Status, Speed, Current, and "Auto" Mode
  2. Flow Rate
  3. Wetwell Level
  4. Fans Status
  5. Power (kw)
  6. Entry Alarm
  7. Gas Alarm
  8. Air Flow Alarm
  9. Man in Trouble Alarm
  10. E-Stops Status
  11. Odor Control Status
  12. 6 Additional Values to be Assigned Later.
- Trend Screens for:
  1. Flow Rate
  2. Level 1
  3. Level 2
  4. Pump 1 Current
  5. Pump 2 Current
  6. Pump 3 Current
  7. Power Usage (kw)
  8. 6 Additional Values to be Assigned Later
- Setpoints for:
  1. PID Level
  2. Pump 1 / Pump 2 / Pump 3 Out of Service / Alternation
  3. 6 Additional Values to be Assigned Later
- Alarms & Historical Data

C. The control panel shall include an audible horn and beacon to indicate the following conditions:

- Ventilation Exhaust Low Air Flow
- Ventilation Supply Low Air Flow
- Gas Alarm
- Man Down (HS-1055)

Provide a silence button on the front of the control panel to silence the horn.

1.5 PROGRAMMING AND CONFIGURATION GUIDELINES AND DELIVERABLES

A. Real Variables Processing

1. Real variables shall represent process data for which there are analog signal inputs to the system. The system shall sample each of these input signals at the selected scan frequency and perform the proper conversions and scaling to obtain the instantaneous engineering values. These values shall be used to update real-time data on HMI displays, check for alarm conditions and store for use in historical files.

2. The instantaneous values of all variable data shall be displayed on the appropriate HMI display and shall be added to the historical database whenever the present value exceeds a preprogrammed compression dead band. The compression dead band will be field adjusted by the PICS to provide for maximum storage utilization.

3. Variables such as rate of flow, weight and kilowatt usage shall have their instantaneous values integrated with respect to time and their quantities totaled before archiving.

4. Alarm conditions shall be stored in a separate historical file. In addition, the last 500 alarms shall be displayed on the alarm graphic display. Provide a USB stick to record alarms and trends. USB stick shall be sized to accommodate a minimum of 1 year of all trended data. Provide a second USB stick for each pump station which will be used for switch-out. Coordinate file format with Owner.

B. HMI Graphic Displays

1. All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers.

2. The HMI displays shall make maximum use of the colors available. Color for status such as start/stop shall be the same as the indicators used on the existing process control system. PICS shall have designated colors for Influent, Effluent, RAS, WAS, Process Air, Raw Sewage, Thickened Sludge, etc. All colors shall be approved by the Owner.

3. Unless specifically noted, all timers, set points, alarm actuation levels, etc. shall be operator adjustable from the HMI.

4. Menu displays shall be provided as a guide to the available display options. The menu displays shall be a complete and logical listing of the names and number of all displays.

5. Graphic displays shall depict basic process schematic diagrams with representative symbols for pumps, tanks, etc. combined with real time process variables or conditions. The equipment represented on the display shall be suitably titled for identity. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.). Its name and tag number shall identify the data on the display. All of the current data in the database shall be available for graphic displays. It shall be possible to easily modify an existing display or generate a new display. The graphic displays shall consist of a single master plant flow schematic and multiple sub-displays detailing specific plant systems or elements. The process graphic displays shall consist of Master, Area and System displays. The Master and Area displays shall show general graphic representations of the facility covered with general equipment, alarm, analytical summaries and control capabilities. The System display shall detail all relevant aspects of the individual equipment or system (i.e., an individual pump). The intent is to provide the operator with an overview (Master) with the capability of "zooming in" on a process (Area) or a piece of equipment (System) as necessary. The PICS shall use the Instrumentation and Piping Diagrams as part of this Contract to generate the graphic displays. All process variables shall be displayed on their associated display (s) in engineering units. The Engineer/Owner shall approve color standards for the equipment symbols, process piping, etc.

6. Analog trend displays shall display the value of a minimum of eight (8) assigned points versus time. The intent is to depict the type of plot produced on an analog recorder on the HMI display. Each point shall be trended in a different color. Each of the assigned points shall have a point identification number, point name, point description, current value and instrument range display in the color used for its trend. The time period shall be selected and be either current or historical. The time period selected and time and date of start shall be displayed. The values displayed on a historical trend shall consist of the stored values for each variable trended. Current trends shall be updated at the scan frequency of the variable. A trend display shall not be considered a graphic display.

7. Alarm summary displays shall consist of all points currently in alarm and shall include the tag number, description, true time of occurrence and present status, (high, low, normal, etc.). The alarm summary shall identify alarm points by severity (event, attention, caution and urgent) by utilizing distinct colors for each severity category. The severity classification shall be easily changeable by the Owner.

8. System status displays shall summarize the error status of all system devices capable of reporting errors to the CPU (i.e., printers, communication devices, etc.). The display shall indicate if an error is detected or a failure occurs. It shall also allow assignment of those items capable of acting as back up to other devices. These displays shall be used primarily for maintenance purposes.

9. Single point configuration / status displays shall be of the HMI software manufacturer's standard format.

PART 2 PRODUCTS

A. The Human Machine Interface shall be a 12" C-More color TFT touchpanel with built-in Ethernet and USB. Provide an 8GB USB stick and the C-More touch panel programming software.

B. The PLC shall be Allen Bradley Compactlogix or Owner approved equal. PICS shall provide a second spare PLC processor. Locate processor on shelf in Control Panel and label. PLC program shall reside on memory stick and placed on shelf.

PART 3 EXECUTION

3.1 TESTING

A. Refer to Section 409000.

B. In addition to the tests specified in Section 409000, perform the following:

1. Building and loading the database

2. Conduct online modifications to the database

3. Demonstrate operability of the interfaces (hardware and software)

4. Demonstrate all system software functions specified

5. Demonstrate operability of all process control strategies, graphic screens and reports

6. Verify the displays and all interactive capabilities of the operators workstations

7. Simulate selected operating conditions to verify the performance of the monitoring and control functions

8. Demonstrate the performance of the historical database

I/O LIST

LCP NO.	EQUIPMENT NO	DESCRIPTION	SIGNAL TYPE
LCP-100	FSL-120A	EXHAUST FAN LOW AIR FLOW	DI
LCP-100	FSL-120B	SUPPLY FAN LOW AIR FLOW	DI
LCP-100	HS-105B	MAN DOWN LOWER LEVEL	DI
LCP-100	XS-115	STATION ENTRY NOTIFICATION	DI
LCP-100	LSH-165	WET WELL HIGH LEVEL ALARM	DI
LCP-100	LCP-135	AIR FLOW ALARM	DO
LCP-100	LCP-135	AIR FLOW ALARM ACKNOWLEDGED	DI
LCP-100	POWER METER	Current Phase A	RS-232
LCP-100	POWER METER	Current Phase B	RS-232
LCP-100	POWER METER	Current Phase C	RS-232
LCP-100	POWER METER	POWER (KW)	RS-232
LCP-100	POWER METER	Voltage Phase A	RS-232
LCP-100	POWER METER	Voltage Phase B	RS-232
LCP-100	POWER METER	Voltage Phase C	RS-232
LCP-100	POWER METER	Current Phase A	RS-232
LCP-100	POWER METER	LOSS OF POWER	RS-232
LCP-100	POWER METER	TO BE ASSIGNED	RS-232
LCP-100	POWER METER	TO BE ASSIGNED	RS-232
LCP-100	POWER METER	TO BE ASSIGNED	RS-232
LCP-100	LCP-125	ODOR CONTROL FAN RUNNING	DI
LCP-100	LCP-125	ODOR CONTROL FAN FAULT	DI
LCP-100	A.T.S.	NORMAL POSITION	DI
LCP-100	A.T.S.	EMERGENCY POSITION	DI
LCP-100	A.T.S.	GENERATOR RUNNING	DI
LCP-100	A.T.S.	GENERATOR FAULT	DI
LCP-100	A.T.S.	DIESEL TANK LOW FUEL	DI
LCP-100	A.T.S.	TO BE ASSIGNED	DI
LCP-100	A.T.S.	TO BE ASSIGNED	DI
LCP-100	VFD-101	LOW LEVEL PUMP 101 CUTOFF	RELAY OUT
LCP-100	VFD-102	LOW LEVEL PUMP 201 CUTOFF	RELAY OUT
LCP-100	VFD-103	LOW LEVEL PUMP 301 CUTOFF	RELAY OUT
LCP-100	VFD-101	VFD 101 RUN COMMAND	ETHERNET
LCP-100	VFD-101	VFD 101 IN AUTO POSITION	ETHERNET
LCP-100	VFD-101	VFD 101 FAULT	ETHERNET
LCP-100	VFD-101	VFD 101 ENABLE	ETHERNET

LCP-100	VFD-101	VFD 101 RUNNING	ETHERNET
LCP-100	VFD-101	PUMP 101 SPEED CONTROL	ETHERNET
LCP-100	VFD-101	PUMP 101 SPEED INDICATION	ETHERNET
LCP-100	VFD-101	PUMP 101 CURRENT	ETHERNET
LCP-100	VFD-101	ES-101 (E-STOP) ACTIVATED	ETHERNET
LCP-100	VFD-102	VFD 102 RUN COMMAND	ETHERNET
LCP-100	VFD-102	VFD 102 IN AUTO POSITION	ETHERNET
LCP-100	VFD-102	VFD 102 FAULT	ETHERNET
LCP-100	VFD-102	VFD 102 ENABLE	ETHERNET
LCP-100	VFD-102	VFD 102 RUNNING	ETHERNET
LCP-100	VFD-102	PUMP 102 SPEED CONTROL	ETHERNET
LCP-100	VFD-102	PUMP 102 SPEED INDICATION	ETHERNET
LCP-100	VFD-102	PUMP 102 CURRENT	ETHERNET
LCP-100	VFD-102	ES-102 (E-STOP) ACTIVATED	ETHERNET
LCP-100	VFD-103	VFD 103 RUN COMMAND	ETHERNET
LCP-100	VFD-103	VFD 103 IN AUTO POSITION	ETHERNET
LCP-100	VFD-103	VFD 103 FAULT	ETHERNET
LCP-100	VFD-103	VFD 103 ENABLE	ETHERNET
LCP-100	VFD-103	VFD 103 RUNNING	ETHERNET
LCP-100	VFD-103	PUMP 103 SPEED CONTROL	ETHERNET
LCP-100	VFD-103	PUMP 103 SPEED INDICATION	ETHERNET
LCP-100	VFD-103	PUMP 103 CURRENT	ETHERNET
LCP-100	VFD-103	ES-103 (E-STOP) ACTIVATED	ETHERNET
LCP-100	FIT-100	FLOW RATE	AI
LCP-100	FIT-100	2A FUSE FOR FIT-100	120V PWR
LCP-100	LCP-145	LEL ALARM	DI
LCP-100	AE-150	LEL GAS SENSOR (LOOP POWERED)	AI
LCP-100	LE-151	WET WELL LEVEL #1 (TRANSDUCER / LOOP POWERED)	AI
LCP-100	LE-152	WET WELL LEVEL #2 (ULTRASONIC / LOOP POWERED)	AI
LCP-100	LCP-110	WET WELL LEVEL #1	AO
LCP-100	LCP-110	WET WELL LEVEL #2	AO
LCP-100	LCP-110	ODOR CONTROL FAULT	DO
LCP-100	LCP-110	GENERATOR FUEL LEAK	DO
LCP-100	LCP-110	GENERATOR RUNNING	DO
LCP-100	LCP-110	GENERATOR TROUBLE	DO
LCP-100	LCP-110	PHASE LOSS (POWER MONITOR)	DO
LCP-100	LCP-110	STATION ENTRY	DO
LCP-100	LCP-110	LEL GAS DETECTED	DO
LCP-100	LCP-110	PUMP 101 RUN	DO
LCP-100	LCP-110	PUMP 101 FAULT	DO
LCP-100	LCP-110	PUMP 102 RUN	DO
LCP-100	LCP-110	PUMP 102 FAULT	DO
LCP-100	LCP-110	PUMP 103 RUN	DO
LCP-100	LCP-110	DRY WELL FLOOD	DO

LCP-100	LCP-110	SUMP PUMP STATUS	DO
LCP-100	LCP-110	AIR FLOW ALARM (EXHAUST/SUPPLY)	DO

Notes:

1. This I/O List is typical for Main Control Panels LCP-200, LCP-300, and LCP-400
2. All analog values shall be recorded be capable of trending including all variables acquired through Ethernet and RS-232.

END OF SECTION

SECTION 40 23 00

PROCESS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Contractor shall furnish, install, and test (where required), all process piping, fittings, accessories and supports as required in this specification.

1.2 REFERENCES

A. ANSI A.21.10 - Standard for Cast Iron Fittings 3 in. through 48 in., for water and other liquids.

B. ANSI A.21.50 - Standard for the Thickness Design of Ductile-Iron Pipe.

C. ANSI B.16.1 - Standard for Cast Iron Pipe Flanges and Flanged Fittings.

D. C115/A21.15 - Standard for Flanged Ductile Iron.

E. ANSI-C-606 - Standard for Joints, Grooved and shouldered Type Fittings.

F. ANSI B.31 - Pressure Piping.

1.3 SUBMITTALS

A. Submit product data under provisions of other Sections of this specification.

B. Include data on pipe materials, pipe fittings and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of other Sections of the specifications.

B. Store and protect products under provisions of other Sections of the specifications.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE

A. Fittings shall be ductile iron or cast iron.

B. Wall penetrations connecting buried outside piping and inside piping, or tank penetrations below water level, shall consist of cast iron wall sleeves imbedded in the concrete with mechanical joint or flanged connections compatible with the piping system.

C. Wall penetrations above grade where there are no concerns of water infiltration shall be as specified in "Sleeves and Plates" in this division.

D. For all ductile iron pipe and cast iron fittings shall be furnished as shown in the piping schedule and on the plans.

E. Joints for ductile iron pipe and cast iron fittings shall be flanged, mechanical joint, push-on joint, or mechanically coupled grooved joint as indicated on the drawings and as specified in "Joining of Pipes" in this division.

F. Where required, pipe and fittings shall be furnished with approved lugs or hooks cast integrally for use with bolts or bridle rods and socket clamps to keep pipe from pulling apart under pressure.

G. All ductile iron pipe and fittings (except air systems) shall be lined and coated as follows:

1. The inside shall be cement-mortar lined (standard thickness) for water service in accordance with ANSI/AWWA C104/A21.4.
2. The outside of underground systems shall be coated with the standard bituminous coating specified under the appropriate ANSI specification for the pipe and fittings.
3. Machined surfaces shall be cleaned and coated with a rust-preventive coating at the shop immediately after being machined.

H. All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. The Contractor shall furnish duplicate to the Owner's Representative sworn certificates of such tests. All inspection and testing at the foundry shall be accomplished at no additional expense to the Owner.

I. Pipes and fittings shall be subjected to a careful inspection and hammer test just before being installed.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC pipe shall be rigid, Type I, Grade I, ANSI/ASTM D-1784, D-1785 polyvinyl chloride Schedule 80 pipe. CPVC pipe shall be Type IV, Grade I, Schedule 80 pipe in accordance with ANSI/ASTM D-1784 and ASTM F-441.

B. Pipe shall be manufactured by:

1. Eslon Thermoplastics, Charlotte, NC
2. Fluid Controls Inc., Huntsville, AL
3. ASAHI/America, Medford, MA
4. LCP Chemicals and Plastics, Colfax, NC
5. Bristol Corp., Bristol, TN

Pipe shall contain less than 10% inert fillers.

C. All pipe shall be joined utilizing socket couplings or fittings by first applying a primer such as that equal to IPS Weld-on P-70, then applying a solvent cement. Flanged fittings may be used. Where threaded pipe must be used, it shall be threaded with new threading dies which shall not be used for the threading of iron or other metal pipe.

D. All PVC pipe shall be leak tested by the manufacturer prior to shipment.

2.3 PIPING SCHEDULE

Service	Pipe Class Or Schedule	Fittings
Pressure Piping Inside Building	DIP flanged with pressure rating of 250 PSI and flanges faced and drilled ANSI B16.1, Class 250 as described in *American Ductile Iron Pipe*, 17th Edition, Table 8-11. Contractor to install couplings as required to transition between pipe and valves to form a compatible match.	Flanges faced and drilled ANSI B16.1, Class 250.
Pressure Piping (Buried)	DIP with MJ ends with Megalug restraint.	MJ Fittings with Megalug restraint.

PART 3 - EXECUTION

3.1 GENERAL

A. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

B. All piping shall be erected true to line and grade by skilled mechanics in strict accordance with the specifications and drawings.

C. Where walls and piping systems are parallel to one another, the piping shall be grouped or arranged to present a symmetrical appearance.

D. All piping connections to pumps and other equipment shall be made in such a manner as to avoid any strain being transmitted from the piping to the equipment. Flanged piping shall be carefully installed so that the pipe flanges exactly match and are perfectly parallel to the flanged equipment connections.

E. Connections of the piping to the equipment with bolts more than finger-tight will not be permitted until the equipment has been leveled, grouted in, and the installation inspected and approved by the manufacturer of the equipment. In the event the piping does not exactly match the equipment connections, the piping installation shall be revised until it does match those connections. In the case of flanged connections, it must be possible to insert the bolts by hand without "springing" the piping. In no event during the erection of the piping shall it be permitted to support the weight of any fitting, valve, piping, etc., from the equipment connections.

F. All piping shall run parallel with the building walls unless otherwise indicated. Diagonal runs will not be permitted. In all walkways, stair and working platform areas, a minimum clearance of 6 feet 8 inches from the floor, stair, or platform to the lowest point of the piping or piping accessory shall be maintained.

G. The Contractor shall be cognizant of the service and design features such as support anchoring, expansion/contraction, and jointing of the piping and valves he proposes to utilize. He shall inform the Owner of any features which are not compatible with the drawings at the time such equipment is submitted for approval.

H. Piping from safety valves shall be the same as inlet piping.

I. All pipe nipples shall be of the same material as the line in which they are installed.

J. The placement of valves, instruments and other components shall be located such that they can be serviced and can be read (in the case of instruments).

K. Unless otherwise indicated on the drawings, maximum spacing of pipe supports for horizontal piping shall be as follows:

Pipe Material	Maximum Spacing Liquids	Air & Gases
1. Ductile Iron		
1-1/2" and under	7'-0"	7'-0"
2", 2-1/2", 3"	10'-0"	14'-0"
4", 5", 6"	14'-0"	20'-0"
8", 10"	20'-0"	20'-0"
12" and above	As recommended by the piping manufacturer	
2. PVC		
2" and under	Continuous support	
2-1/2" and above	As required by manufacturer for service temperature	

L. Provide additional supports, a) where pipe changes direction, b) adjacent to flanged valves and strainers, and c) at equipment connections and heavy fittings. Provide at least one hanger adjacent to each joint in cast-iron soil pipe and grooved-end steel pipe with mechanical couplings.

3.2 INSTALLATION

A. Pipe Erection and Laying:

1. Carefully inspect all pipe, fittings, valves, equipment, and accessories prior to installation. Any items which are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings or nameplates with sufficient data for identification to determine their conformance with specified requirements.
2. Exercise all necessary care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item which is not clean. During construction, until system is fully operational, all openings in piping and equipment must be kept closed at all times except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
3. Run pipelines straight and true, parallel to building lines with a minimum use of offsets and couplings. Provide only such offsets as may be required to

provide necessary headroom or clearance and to provide necessary flexibility in pipe lines.

4. Changes in direction of pipelines shall be made only with fittings or pipe bends. Changes in size shall be made only with fittings. Miter fittings, face or flush bushings, or street elbows shall not be used. All fittings shall be of the long radius type, unless otherwise shown on the drawing or specified.
5. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
6. Use full and double lengths of pipe wherever possible.
7. Unless otherwise indicated, install all supply piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at inlet to control valve or pump. Install supply piping from outlet of control valve at full size to connection of equipment served.
8. All pipe shall be cut to exact measurement and installed without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or building elements with piping connections or piping supports.

B. Hangers and Supports:

1. The requirements of the applicable sections of ANSI B31 "Pressure Piping" shall be considered as minimum requirements governing fabrication, installation and support of piping systems except where more specific or stringent requirements restated herein or shown on the drawings.
2. In general, all pipe hangers larger than 10 inches diameter shall be supported from foundations, beams or roofs. Piping smaller than 10 inches may be supported from or on the building slabs. Pipe hangers shall be in accordance with those manufactured by Fee & Mason, Manasquan, NJ; ITT Grinnell Corp., Providence, RI; Carpenter & Patterson, Inc., Woburn, MA, or equal.
3. All piping and piping connected equipment, including valves, strainers, traps and other specialties and accessories shall be supported in a manner that will not result in or product objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or in the building structure either during erection, cleaning, testing or normal operation of the systems. Piping shall not be so restrained, however, as to cause it to shake or buckle between supports or anchors or to prevent proper movement due to expansion and contraction. Piping shall be supported at equipment and valves such that they can be disconnected and removed without further supporting the piping. Piping shall not introduce any strains or distortion to the connected equipment.
4. All concrete inserts for support shall be set in place prior to pouring concrete.
5. All auxiliary structural steel required for the support of piping systems and not shown on the drawings as having been installed as a part of the building structure shall be furnished, installed and prime painted as part of the work under this section. Attach auxiliary steel to building structure as detailed on the drawings.
6. Hangers and supports shall be installed complete, including lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessory items. Hangers for horizontal piping shall have adequate means of vertical adjustment for proper alignment of pipe and shall be provided with lock nuts. All hangers and supports in direct contact with copper tubing shall be copper plated or plastic coated.
7. Parallel runs or horizontal pipe 3 inches and under may be supported on trapeze type hangers made up of structural shapes and hanger rods. Otherwise, pipe lines shall be supported with individual pipe hangers.
8. Hanger rods for both single and double rod hangers shall conform to the following:

a. It shall be the responsibility of the Contractor to coordinate the location and method of support of the piping systems with that of all installations under other sections of the specifications. Piping shall be supported in such a manner as to impose no eccentric loading on building structural members. The loading of any hanger or support shall in no case exceed the manufacturer's recommended maximum load.

b. Hangers for insulated piping shall be sized for the OD of the pipe insulation or the insulation protection saddle.

c. Pipe hangers and supports are not shown on the plans. Contractor is responsible for coordination of the design, subject to Engineer's approval of a suitable hanger and/or support system.

C. Sleeves and Plates:

1. Provide sleeves for all pipes passing through floors, walls, partitions, slabs, grade beams and foundations.
2. Lay out, size and locate all sleeves such that they be set and/or installed prior to pouring concrete or when masonry is being constructed. In the event sleeves must be placed after floor, wall, grade beam, etc., has been constructed, submit in writing to the obtain approval from the Owner, quantity and proposed method of core drilling and installing. Cored openings must be clean and neat without cracking or spalling.
3. Unless otherwise specified, sleeves shall be standard weight galvanized steel pipe having square cut ends with anchoring lugs welded on. Horizontal sleeves through walls, grade beams, foundations and partitions shall be flush with finished wall faces and have a water stop. Vertical Sleeves through floors shall extend 3 inches above finished floor and be flush on ceiling or under side.
4. Size sleeves such that internal diameter is a minimum of 2 inches larger than OD of bare pipe for un-insulated lines and 2 inches larger than OD of insulation and jacket for insulated lines. Center pipes in sleeves. Sleeves in pits or below grade shall be painted or coated with one coat of coal tar pitch paint and have an integral waterstop.
5. On lines passing through floors, slabs, walls, grade beams or foundations at or below grade and in pits, the annular space between outside of pipe or insulation and inside of sleeve shall be packed with oakum to within one inch of both sides and the remaining space filled with asphaltic mastic. On lines passing through walls and floors above grade, and annular space between outside of pipe or insulation and inside of sleeve shall be packed tight with fiberglass insulation.

D. Expansion, Anchoring, Guiding and Thrusting:

1. Pipeline anchors and alignment guides shall be as required or as herein specified.
2. Pipe expansion loops and offsets shall be provided as required.
3. Alignment guides shall consist of a bolted semi-steel spider and a bolted guiding cylinder with supporting legs welded to the pipe support. Guides shall be as manufactured by Tube Turns Div., Allegheny Ludlum Industries, Louisville, Ky; Metraflex Co., Chicago, IL.

3.3 JOINING OF PIPES

A. General:

1. The joining of pipes shall be in accordance with the system acceptable and recommended by the manufacturer of the piping system. The joining methods herein described and described in the section "Piping and Tubing Materials" are a guide.
2. Threaded piping connections for plastic pipe are not to be used. In the connection of plastic pipe to a metal pipe, flanged connections shall be used.

B. Threaded Joints:

1. Pipe screw threads to conform to ANSI B2.1. Ream pipe ends and remove all burrs and chips after cutting and threading. Protect pipe thread during assembly. Apply thread lubricant to male threads as follows: John Crane Co., Morton Grove, IL, "Anti-Seize" for steam and condensate, boiler feed water and blow-down; read lead graphite for vent lines and roof conductor and Teflon tape for all other services.

C. Flanged Joints:

1. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanges and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.
2. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.
3. Bolting for services up to 500 degrees F shall be ANSI/ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts". Bolt studs and studs shall be of the same quality as machine bolts.
4. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
5. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets 12 inches in diameter and smaller shall be 1/16 inch thick minimum; larger than 12 inches in diameter shall be 3/32 inch thick minimum and of following types:
6. Water and Sludges (up to 175 degrees F): Red rubber, heavy duty type, by John Crane Co., Morton Grove, IL, - Style 555.

D. Solder Joints:

1. Make up joints with 95% tin and 5% antimony (95-5) solder conforming to ANSI/ASTM B32 "Solder Metal" Grade 95TA. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly to proper soldering temperature so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting. Flux shall be non-acid type. Remove composition discs from solder end valves during soldering.

E. Mechanically Coupled Grooved Joints:

1. Mechanical coupling connections shall mechanically engage, lock and seal the grooved pipe ends in a positive couple. Each coupling shall consist of malleable iron housing clamps in two or more C-shaped composition sealing gaskets, designed such that internal pressure tends to increase the tightness of the seal and two or more track-head steel bolts. The entire installation, including pipe grooving, shall be accomplished in accordance with the manufacturer's published instructions. Final tightening of bolts shall be with a torque wrench to insure equal tension in all bolts.
2. Approved manufacturers are Gustin Bacon Div. of Aeroquip Corp., Lawrence, KS, (Style 100 with Type 1 gaskets) and Victaulic Company of America, South Plainfield, NJ, (Style 77 with Grade T gaskets for steel pipe;, and Style 31 with flush seal gaskets for cast iron and ductile iron pipe).
3. Couplings used for the accommodation of drop nipples, branches, sprinkler heads, gauges or other male threaded connections shall be Style 96 FIT reducing tee, as manufactured by Victaulic Company of America, South Plainfield, NJ, or approved equal.

Mechanically Coupled Plain End Joints:

4. Mechanical coupling connections shall mechanically engage, lock and seal the steel pipe plain ends in a positive couple. The coupling housing shall be cast with oval shaped bolt holes. The assembly shall include a gasket which seals without pressure or vacuum when properly assembled. The couplings shall be Style 99 Roust-A-Bout with steel jaws which engage the pipe. Manufacturer is Victaulic Company of America, South Plainfield, NJ. Pipe preparation and assembly shall be in accordance with manufacturer's specifications. The assembly must be made with nuts tightened to the full torque requirements which depend on size.

F. Mechanical Joints:

1. Joints shall conform to ANSI A21.11 "Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings". Gasket material shall be Neoprene. The standard bolts and nuts of the pipe manufacturer shall be used and shall be coated at the factory with rust preventive lubricant after threading and tapping. Final tightening of bolts shall be with a torque wrench to insure equal tension in all bolts.

G. PVC Pipe:

1. The following procedures are recommended for the assembly of solvent cements welded PVC pipe and fittings:
2. Cut the pipe ends to be fitted square and smooth.
3. Where the pipe diameter is too large to fit in the socket of fittings, use emery cloth to remove excess material.
4. Wipe end of pipe and sockets of fitting lightly with a cloth moistened with methyl ethyl ketone to clean off dirt; grease and other foreign materials.
5. Apply primer.
6. Apply a coat of solvent cement to both ends of pipe and socket of fittings, by means of a paint brush made of natural (hog) bristle.
7. Insert pipe in socket and press to bottom of socket, then rotate the pipe in socket about one-quarter to one-half turn. A check that sufficient cement has been applied is indicated when a full fillet forms between the pipe and the edge of the socket.
8. Joints may be tested with water after four h ours under pressures not exceeding ten percent of the rating. Full working pressure may be applied after the joints have been allowed to stand for at least two days.
9. The use of solvent alone, such as methyl ethyl ketone, as differentiated from solvent cement discussed above, will not be allowed because of the uneven and relatively large clearance between the spigot and the socket, hence the inability to affect a proper and continuous adhesion between all the surfaces involved.
10. Where flanged PVC is used, gaskets shall be used in all cases. All fittings shall be of the molded type.

3.4 PROCESS PIPING CLEANING

A. All water lines shall be flushed out under full treated water pressure; potable water piping shall be flushed with potable water; air piping shall be thoroughly blown out with air. All filters, control valves and gages shall be removed from lines or bypassed during the blowout period.

B. Following the blow-through, all dirt legs and other low points in lines shall be disassembled and all residual material thoroughly removed. All stop valves shall be removed and cleaned.

3.5 TESTING PREPARATION

A. The Contractor shall furnish all equipment and labor necessary to perform the field tests called for in this specification.

B. The Contractor shall give ample notice to the Owner that tests are to be conducted. The Owner or his Representative will witness the tests if he wishes.

C. No test shall be performed until all anchors, hangers, supports, test gages, plugs, bulkheads, blanks, etc., are installed. Tests shall be made against bulkheads or where permitted by the Owner.

D. Piping that connects to or is continuous with lines installed by others shall be isolated from such lines by valves or test blanks located at or near the junctions. When necessary to include parts of such lines in the test, the Owner's Representative shall be given prior notice so that test conditions may be mutually agreed upon.

E. When exposed piping is required to be painted or insulated, the paint or insulation shall not be applied to the pipe joints until the tests are completed.

F. Safety precautions shall be taken to prevent open ends of piping being in position to cause injury to personnel when blowing out or testing systems.

G. One or more calibrated indicating test gages shall be connected directly to the piping as necessary to coordinate the pressuring operation. The indicating gages shall be visible to the operator controlling the pressure. Pressure gages used shall have dials graduated over a range approximately 2 times the intended maximum test pressure.

3.6 TESTING METHODS

A. Pressure Pipelines - Liquid:

1. All pressure pipelines conveying liquids and steam shall be tested by the Contractor in a manner satisfactory to and witnessed by the Owner's Representative.
2. The section under test shall be filled with water; air expelled from the line and maintained full of water for a period of not less than 24 hours.
3. The pressure and leakage test shall first consist of raising the water pressure (based on the elevation of the lowest point of the section under test and corrected to the gage elevation) to a pressure 1.5 times operating pressure and maintaining such pressure for a period of 30 minutes.
4. The pressure and leakage test shall then consist of dropping the water pressure (based on the elevation of the lowest point of the section under test and corrected to the gage elevation) to a pressure of 1.2 times operating pressure. Such test shall be maintained for an additional 1-1/2 hours.
5. For all pipelines not underground the section tested shall be considered as having failed to pass the test if the pressure test cannot be maintained without additional pumping.
6. For all underground piping at the end of the test period for both the pressure test and the leakage test, the section tested will be accepted if the total leakage is not greater than that determined by the following formula:

   $$L = \frac{ND \left(\text{square root of } P\right)}{3700}$$

   Where:

   L = Allowable leakage in GPH

   N = Number of joints in section tested

   D = Nominal pipe diameter in inches

   P = Average test pressure during test in psig

7. If the section fails to pass the pressure and leakage tests, the Contractor shall do everything necessary to locate, uncover and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.

END OF SECTION

SECTION 40 90 00

PROCESS INSTRUMENTATION AND CONTROL SUPPLIER

PART 1 GENERAL

1.1 SCOPE OF WORK

A. A Process Instrumentation and Control Supplier (PICS) shall furnish all services and equipment specified herein and in other specification sections as listed in Article 1.2 – Related Work. Sub-suppliers and/or manufacturers may provide components, and/or services to the PICS, but the final product shall conform to this specification and shall be the sole responsibility of the PICS.

B. The Process Instrumentation and Control Supplier (PICS) shall report directly to the General Contractor.

C. All materials, equipment, labor and services required to achieve a fully configured, integrated and operational process control system shall be provided by the PICS. The PICS shall design and coordinate the process control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications and with related existing equipment.

D. Application software programming for the Programmable Logic Controllers (PLC) and Human Machine Interface (HMI) computers shall be provided by the PICS. All programming, configuration and integration, including but not limited to loading of software on computers, operating system software configuration, fiber optic data highway communications between control panels, servers and PLCs shall be provided by the PICS.

E. Auxiliary and accessory devices necessary for complete system operation or performance to interface with existing equipment or equipment provided by other suppliers under other sections of these specifications, shall be included whether or not they are shown on the drawings. These devices include but are not limited to, transducers, current isolators, signal conditioners or interposing relays.

F. Substitution of functions or type of equipment specified shall not be acceptable, but the PICS is encouraged to recommend changes in the design that will improve the overall process control system subject to approval by the Engineer. In order to ensure interchangeability of parts, maintain quality, interface between other subsystems, and establish minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. System design shall allow removing devices from service without disrupting other devices in the process control system.

G. Equipment shall be fabricated, assembled, installed and placed in proper operating conditions in full conformity with detail drawings, specifications, engineering data, instructions and recommendations by the equipment manufacturers as approved by the Engineer.

H. To facilitate the Owner's future operation and maintenance efforts, similar products shall be by the same manufacturer, as much as possible.

I. The Owner shall retain salvage rights to all materials and equipment removed in the course of this work. All materials and equipment retained by the Owner shall be delivered to a location designated by the Owner. Any material or equivalent not retained

by the Owner shall be removed from the site and properly disposed of by the General Contractor in accordance with applicable regulations and laws.

J. All equipment and installations shall be in accordance with Federal, State and Local codes, regulations and laws.

K. Where applicable, the PICS shall coordinate with other suppliers under other sections of these specifications on the following:

1. Interface requirements.

2. PLC input and output (I/O) requirements.

3. Consistency of instrumentation.

4. PLC communication requirements.

5. Transfer of data.

6. HMI graphic screen design.

7. Control requirements.

L. All materials, equipment, labor and services necessary to achieve the monitoring, control and reporting functions described herein shall be provided in a timely manner so that the monitoring, control and reporting functions are available when the equipment or process is ready to be placed in service.

M. The PICS shall coordinate and schedule all required testing and training with the General Contractor, Engineer and Owner in a timely manner.

N. The PICS shall submit a monthly status report and updated project schedule to the General Contractor so that the General Contractor can integrate the PICS work into the overall project schedule.

1.2 RELATED WORK

A. The PICS shall furnish all materials, labor and services specified in Division 13 and the drawings, as required to ensure a complete coordinated process control system. Division 13 specifications include:

1. Section 40 95 13 – Process Control Panels

2. Section 40 05 00 – Application Engineering Services

3. Section 40 91 00 – Instrumentation Devices

B. Divisions requiring coordination shall include, but not be limited to, the following:

1. Division 100000 – General Requirements

2. Division 250000 – Mechanical

3. Division – 260000 – Electrical

C. The PICS shall coordinate with all equipment suppliers, subcontractors including mechanical and electrical and the General Contractor.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Division 100000 requirements. These submittals shall fully demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and provide a true and complete record of the equipment as manufactured and delivered. Each submittal shall be securely bound with an index and sectional dividers. All submittal drawings shall be legible and a maximum size of 11-inches by 17-inches.

B. The Engineer shall determine whether a product is an “Approved Equal” based upon the information specified herein and the manufacturer’s data sheets regarding the models specified. Substitute or alternate equipment must meet the criteria listed herein and any additional information in the manufacturer’s data sheets in order to be accepted as an “Approved Equal”. The supplier must furnish at the Engineer’s request five (5) working installation references for any substitute or alternative equipment along with reference Owner, contact and telephone number.

C. Submittals listed below shall be provided as a minimum. Each submittal must be complete in order to be reviewed by the Engineer. A total of ten (10) submittals of each type is required.

1. Field instruments
2. Control Panel system hardware and software
3. Control panels, panel mounted equipment and wiring, back panel layout, etc.
4. Instrument loop diagrams
5. Process Control Descriptions
6. Ladder logic for Proportional/Integral Derivative (PID) control
7. Spares and test equipment
8. Operation and maintenance manuals (O&M)
9. As-built documentation

D. Submittal Descriptions.

1. Field Instruments

a. This submittal shall provide complete documentation of all field instruments. A complete Bill of Materials (BOM) listing all field instrumentation equipment shall be provided.

b. Provide data sheets for each instrument listing model numbers, options and ancillary devices that are being provided. Data sheets shall be provided with

an index, proper identification and appropriate cross-referencing. Data sheets shall include, but not be limited to, the following information:

1. ISA instrument tag number
2. Item name used herein and on the Drawings
3. Manufacturer's complete model number
4. Physical installation location
5. Input or output characteristics
6. Range, units, size and graduations
7. Physical dimensions
8. Enclosure dimensions
9. NEMA classification
10. Mounting details
11. Materials of construction
12. Instrument sizing calculations, where applicable
13. Calibration data (Certified for all flow metering devices)

c. Provide manufacturer's equipment specifications, which shall fully describe each device, the intended function, how it operates, and its physical environment and performance characteristics. As a minimum, the specification sheets shall include the following:

1. Complete information regarding the instrument.
2. Description of operation
3. Performance characteristics
4. Calibration standards
5. Environmental characteristics
6. Electrical requirements
7. Process requirements
8. Materials of construction
9. Physical dimensions and clearance requirements
10. Installation details
11. Maintenance and calibration requirements

12. Spare parts, special tools and test equipment requirements

2. PLC System Hardware and Software

   a. This submittal shall provide complete documentation of all PLC system hardware and software. A complete Bill of Materials (BOM) listing all PLC system hardware and software shall be provided.

   b. Provide data sheets for each component of the PLC system hardware and software listing model numbers, options and ancillary devices that are being provided. Data sheets shall be provided with an index, proper identification and appropriate cross-referencing.

   c. Provide manufacturer's equipment specifications, which shall fully describe each device, the intended function, how it operates, and its physical environment and performance characteristics.

   d. Provide a complete PLC System Input/Output (I/O) List for all equipment connected to the PLC system under this Contract. The I/O List shall fully identify and describe each I/O point in the SCADA system, the intended function, how it operates, and its physical location and performance characteristics. As a minimum, the I/O List shall include the following:

      1. I/O Point Address (PLC name, PLC address and point address)

      2. I/O Physical Address (Panel name, rack, slot, etc.)

      3. I/O Alarms, limits and tag names

      4. Identify Instruments for 2-wire or 4-wire configuration

      5. Any other applicable data

   e. The submittal shall also contain all planning information, site preparation instructions, power supply and grounding procedures, cabling diagrams, system identification, safety precautions and equipment layouts in order to enable the General Contractor to proceed with detailed site preparation for all equipment.

3. Control Panels, Panel Mounted Equipment and Wiring

   a. This submittal shall provide complete documentation of all control panels, panel mounted equipment and related wiring. A complete Bill of Materials (BOM) listing all panels and panel-mounted equipment shall be provided.

   b. Provide data sheets for each panel, equipment or instrument listing model numbers, options and ancillary devices that are being provided. Data sheets shall be provided with an index, proper identification and appropriate cross-referencing. Data sheets shall include, but not be limited to, the following information:

1. ISA instrument tag number
2. Item name used herein and on the Drawings
3. Manufacturer's complete model number
4. Physical installation location
5. Input or output characteristics
6. Range, units, size and graduations
7. Physical dimensions
8. Enclosure dimensions
9. NEMA classification
10. Mounting details
11. Materials of construction
12. Instrument sizing calculations, where applicable
13. Calibration data

c. Provide manufacturer's equipment specifications, which shall fully describe each device, the intended function, how it operates, and its physical environment and performance characteristics. As a minimum, the specification sheets shall include the following:

1. Complete information regarding the panel, equipment or instrument as required by ISA-S5.4 standards.
2. Description of operation
3. Performance characteristics
4. Calibration standards
5. Environmental characteristics
6. Electrical requirements
7. Process requirements
8. Materials of construction
9. Physical dimensions and clearance requirements
10. Installation details
11. Maintenance and calibration requirements
12. Spare parts, special tools and test equipment requirements

d. Provide detailed drawings for all control panels, PLC panels, consoles, etc. which shall include, as a minimum, the following:

1. Panel assembly and physical layout drawings to scale. Drawings shall include exterior front and side views, as required to show the physical dimensions of the panel and all exterior mounted equipment. Drawings shall also include interior views of all sub-panels mounted within the enclosure.

2. Material and paint specifications.

3. Fabrication details.

4. Panel wiring diagrams showing all power connections to equipment within and mounted on the panel, panel power requirements, breaker sizes, fuse sizes and grounding requirements. The diagram shall be in ladder logic format and shall cross-reference all appropriate loop drawings for continuation or detail where required. The diagram shall include wire numbers and terminal block designations as required to complete the drawing.

e. The submittal shall also contain all planning information, site preparation instructions, power supply and grounding procedures, cabling diagrams, system identification, safety precautions and equipment layouts in order to enable the General Contractor to proceed with detailed site preparation for all equipment.

f. The submittal shall also include power calculations for UPS sizing and heat dissipation calculations for each enclosure.

1.4 REFERENCE STANDARDS

A. Instrument Society of America (ISA)

1. ISA S5.2 – Binary Logic Diagrams for Process Operations

2. ISA S5.3 – Graphic Symbols for Distributed Control / Shared Display Instrumentation Logic and Computer Systems

3. ISA S5.4 – Instrument Loop Diagrams

4. Display Instrumentation Logic and Computer Systems

B. American National Standards Institute (ANSI)

1. ANSI X3.5 – Flowchart Symbols and Their Usage in Information Processing

C. National Electrical Manufacturers Association (NEMA)

D. National Electric Code (NEC)

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

1.5 PICS QUALIFICATIONS

A. The PICS shall be regularly engaged in the design and installation of computerized PLC and SCADA systems and their associated subsystems as they apply to the municipal water or wastewater industry. The PICS shall be an organization that complies with all of the following criteria:

1. Maintains a fully equipped office / production facility capable of fabricating, configuring, installing, calibrating, troubleshooting and testing the system specified herein.

2. Employs qualified technicians with 10 years of experience to troubleshoot and repair the specified controls, and that can respond to the job site within 24 hours.

3. Has completed work of similar or greater complexity on at least five (5) projects within the last ten (10) years including the specified PLC hardware and HMI software.

4. Has been in the water / wastewater industry performing the type of work specified for at least the last ten (10) years.

B. The PICS shall provide on-site supervision of the installation of the entire SCADA system specified herein.

C. The approved PICS companies are:

1. Global Controls
2. JK Duren (Mr. Ken Duren – 770-992-5405)
3. Control Automation (Mr. Jim Besselman – 770-928-7690)
4. Southern Flow (Mr. Rod Strub – 770-667-5169)
5. C2I
6. M/R Systems
7. Transdyn

1.6 WARRANTY

A. Provide warranties per Division 100000 requirements and Operation and Maintenance Manuals and as specified herein.

1.7 O & M MANUALS

A. Prior to final acceptance of the system and owner training, operating and maintenance manuals (O&M) covering instruction and maintenance on each type of equipment shall be furnished.

B. Prior to final acceptance, the PICS shall furnish the Owner with the uncompiled PLC program and HMI program.

PART 2 PRODUCTS

2.1 GENERAL

A. Process Control System

1. All equipment and instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals, which are established standards for the water and wastewater industry.

2. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1 to 5 VDC (volts direct current), or the like.

3. Output of equipment, not of the standard signals as outlined above, shall have the output immediately raised and / or converted to compatible standard signals for remote transmission. Zero based signals shall not be allowed.

4. All instruments shall be provided with mounting hardware, floor stands, wall brackets or instrument racks as shown on the Drawings or as required.

5. Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the Drawings to comply with the National Electric Code.

6. All indicators and recorder readouts shall be linear in process units, unless otherwise noted.

7. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent (2%).

8. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture or fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 95 % relative humidity. Field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

9. All equipment, cabinets, consoles and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models, which are currently in production. All equipment provided shall be modular construction and shall be capable of field expansion.

10. Field-mounted digital system equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

11. All electronic and digital equipment shall be provided with radio frequency interference protections and shall be FCC approved.

B. Electrical

1. All equipment shall be designed to operate on a 60-hertz alternating current power source at a nominal 120 volts, +/- 10%, except where specifically noted. All regulators and power supplies required for compliance with the above shall be

provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

3. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

PART 3 EXECUTION

3.1 INSTALLATION

A. The PLC system, instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. All information relevant to the placing of SCADA work shall be obtained in the field. In case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

B. The instrumentation loop diagrams indicate the intent of the interconnections between the individual instruments. Any exceptions shall be noted. Two (2) complete sets of approved shop drawings shall be kept at the jobsite during all on-site construction work. Both sets shall be marked up identically to reflect any modifications made during field installation or start-up. All markings shall be verified and initialed by the Engineer or his designated representative.

C. Following completion of installation, one (1) set of the marked up drawings shall be provided to the Engineer; the other set shall be retained by the PICS for incorporation of the mark-ups into final as-built documentation.

D. The instrumentation installation details in the Drawings indicate the designed installation for the instrument specified.

E. All work shall be executed in full compliance with codes, ordinances, regulations and local rulings. Should any work be performed contrary to said codes, ordinances, regulations or local rulings, the General Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

F. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Drawings for the specific locations.

G. Unless specifically shown in the Drawings, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands as detailed on the installation detail drawings. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, valve manifold for calibration, testing and blowdown services shall also be provided. For slurries, chemical or corrosive fluids inline diaphragm seals shall be provided.

H. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors and shut-off valves.

I. Field instruments requiring power supplies shall be provided with local electrical shutoffs and fuses as required by the National Electric Code or as shown on the Drawings.

J. Brackets and hangars required for equipment mounting shall be provided and shall be installed in a workmanlike manner and shall not interfere with any other equipment.

K. The PICS shall investigate each space in the building through which equipment must pass to reach its final destination. If necessary, the PICS shall be required to ship material in sections sized to permit passing through restricted areas in the building. The PICS shall also investigate and make any field modifications to the allocated space for each panel, enclosure and console to assure proper space and area around it (front, rear, side).

L. The shield on each process instrumentation cable shall be continuous from source to destination and shall be grounded as directed by the manufacturer of the instrumentation equipment, but in no case shall more than one ground point be employed for each shield.

M. Lifting rings shall be removed from panels, enclosures and consoles and the remaining holes plugged using the same color as the panel.

N. The PICS, acting through the General Contractor, shall coordinate the installation, the placing and location of system components, and their connections to the process equipment panels, cabinets and devices, subject to the Engineer's approval. The PICS shall be responsible for ensuring that all field wiring for power and signal circuits is done correctly in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The General Contractor, hereunder, shall schedule and coordinate his work under this Section with that of the electrical work specified under applicable Sections of Division 26.

3.2 TESTS (GENERAL)

A. The PICS shall test all equipment at the factory prior to shipment. Unless otherwise specified in the individual specification sections, all equipment provided by the PICS shall be tested at the factory as a single fully integrated system.

3.3 7-DAY SITE ACCEPTANCE TEST (SAT)

A. The PICS shall be responsible for operation of the entire system for a period of 7 consecutive days, under conditions of full pump station process operation, without a single non-field repairable malfunction.

B. During the test, plant operating and PICS personnel shall be present as required. For this test, the PICS is expected to provide personnel who have intimate knowledge of the system hardware and software.

C. While the test is proceeding, the Owner shall have full use of the system. Only certified plant operating personnel shall be allowed to operate equipment associated with the actual water production process.

D. Any malfunction during the tests shall be analyzed and corrected by the PICS. The Engineer/Owner will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

E. During the 7 consecutive day test period, any malfunction which cannot be corrected within 24 hours of occurrence by PICS personnel, or more than two similar failures of any duration, will be considered a non-field-repairable malfunction.

F. Upon completion of a non-field-repairable malfunction by the PICS, the test shall be repeated as specified herein.

G. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided shall not contribute to the availability test time above.

H. Down times due to plant process equipment failures or other factors beyond the control of PICS shall not contribute to the availability test time above.

I. Upon successful completion of the SAT and subsequent review and approval by the Engineer of the complete system final documentation, the system shall be considered substantially complete, and a one-year warranty period shall commence.

3.4 TRAINING

A. General

1. The cost of training programs for the Owner's personnel shall be included in the Contract price. Where practical, the training and instruction shall be directly related to the system being applied.

2. Training shall be conducted at the PICS facility or the Owner's facility.

3. All Technicians, Operators, Engineers and Managers of the facility shall require training on the system. The training courses shall address operation, maintenance and troubleshooting of the system provided. The courses shall be designed specifically for the type of personnel attending, such as Operators, Engineers, etc.

4. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training shall be used where required by the Owner's operations schedule.

5. Provide detailed training manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

6. The trainer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, all training materials shall be delivered to the Owner.

7. The Owner reserves the right to videotape all training sessions. All training tapes shall become the sole property of the Owner.

B. HMI Training

1. PICS On-Site Training

   a. The PICS shall provide one or two days of on-site training for the plant operators. Training shall focus on the following:
      i. Manipulating the HMI Screens
      ii. Alarms / Alarm Acknowledging
      iii. Trending
      iv. Changing Set Points

C. Field Training

1. Field and Panel Instruments

a. Provide training course for two (2) of Owner's personnel in the operation, configuration, programming, installation and maintenance of the field and panel-mounted instrumentation system supplied.

b. Training shall consist of classroom and hands-on instruction utilizing the Owner's system.

c. The following training shall be provided, as a minimum:

1. Training in standard hardware maintenance.

2. Specific training for the actual instrumentation configuration to provide a detailed understanding of how the equipment and components are arranged connected and set up for this Contract.

3. Test, adjustment and calibration procedures

4. Troubleshooting and diagnostics

5. Periodic maintenance

6. A walk-through of the installed system explaining each major component of the system.

3.5 CONTROL SYSTEM DIAGRAMS AND DETAILS

A. To assist the PICS in determining the scope of work, the PICS shall see the instrumentation drawing(s) and details. Unless specifically stated otherwise, the PICS shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on the Drawings. Any auxiliary devices such as lightning/surge protectors, relays, timers, signal isolators, signal boosters, etc., which are necessary for complete operation of the system, or to perform the functions specified, shall be included whether or not they are specifically shown or tabulated on the loop drawings.

END OF SECTION

SECTION 40 91 00

INSTRUMENTATION DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Primary elements.

B. Transmitters.

C. Receivers.

D. Analytical instruments.

E. Devices.

F. Cables.

1.2 RELATED SECTIONS

A. 40 90 00 - Process Instrumentation & Control Supplier.

1.3 REFERENCES

A. 40 90 00 - Process Instrumentation & Control Supplier

B. American Society for Testing and Materials (ASTM)

1.4 SYSTEM DESCRIPTION

A. System consists of all field and panel mounted instrumentation devices as noted, complete with all necessary signal converters, isolators, amplifiers, power supplies, cables and other appurtenances necessary for interfacing with other components.

B. Except as noted, scale all indicators in engineering units.

1.5 SUBMITTALS

A. Submit product data.

PART 2 - PRODUCTS

2.1 INSTRUMENTS AND DEVICES

A. Level Transmitters – Ultrasonic (LE-152 ,LE-252, LE-352, & LE-452)

1. Type: Microprocessor based 2-wire ultrasonic level transmitter with integral display. Unit shall have input or output filter capability.
2. Sensor: Sensors shall have minimum 66 foot range. Sensor shall have an aluminum housing coatd to IP68 NEMA 6P. Unit shall be supplied with automatic temperature compensation. Sensor face material shall be Kynar or Teflon as required. Sensor shall be UL listed and rated for Class 1, Division 1.
3. Accuracy: ± 1.0 percent of calibrated range or better for ranges greater than 25-inches (with temperature compensation).
4. Output: Isolated 4-20 mADC into loop loads of 0 to 500 ohms (minimum), two (2) Form "C" Relay Contacts rated at 5A, 250 VAC, non-inductive.
5. Enclosure: NEMA 4X, polycarbonate or fiberglass.
6. Power Supply: 120 VAC
7. Mounting: The System Manufacturer shall coordinate mounting to ensure that the sensor is mounted away from vessel walls and other obstructions in accordance with the manufacturer's recommendations. The System Manufacturer shall provide appropriate standoff distance for sensor face from the highest liquid level to accommodate blanking distance.
8. Acceptable Manufacturers: Equal to Endress & Hause Prosonic M FMU44, Siemens, or Rosemount equal.

B. Level Transmitter (Submersible Head-Type) (LE-151, LE-251, LE-351, & LE-451)

1. Type: Pressure sensor
2. Sensor: 316SS sensor housing, 1.66" thick and pressure sensor diaphragm with 50' of viton cable. Polarity independent leads for 24 VDC powered loop. Atmospheric compensation tube built into cable. Sensor shall be UL listed and rated for Class 1, Division 1.
3. Cleaning: Not required
4. Reference Accuracy: +/ 0.2%
5. Hart compatible
6. Sensor Mountings:
    a. PVC hanger with minimum of 4" of cable contact and SS cable for hanging to eye bolt on side of tank or as specified on instrument chart.
    b. Sensor will be mounted in stilling well.
7. Start-Up: provide minimum of 2 hours/meter of service by factory-authorized representative for system start-up plus ½ day of training.
8. Acceptable Manufacturer: Endress Hauser Waterpilot FMX21, Rosemount, or Siemens equal that meets or exceeds the specifications prior to bid opening.

C. Level Switch (Float Type) (LSH-165, LSH-265, LSH-365, & LSH-465)

1. Type: Submersible coated 316 stainless steel, polypropylene, or polyethylene body; non-mercury switch contact rated 4 amps at 120 VAC; normally open, normally closed, or Form C (N.O. and N.C.) contact configuration as indicated. Mercury float switches are unacceptable.
2. Cable: Minimum 18 gauge, 300 volt (minimum) rated; heavy-duty type SOW or equivalent. Provide sufficient length for mounting at the elevations indicated.
3. Junction Box: Provide NEMA 4X stainless steel junction box, mounted near the switch, for terminating vendor supplied cable and discrete control wiring to control panel.

4. Switch Mounting: The System Manufacturer shall provide 3/4 or 1 inch Schedule 40 PVC, 316 stainless steel pipe, or 1.25 inch cable for mounting the floats for a particular tank or well. The pipe shall extend from two feet above the highest switch setting (up to the top of the vessel) to two feet below the lowest level

setting (down to the vessel bottom) for the vessel or well and allow for adjustment of the switch or switches anywhere along the length of the pipe. The method for fixing the float to the pipe shall be easily adjustable and shall provide for protection and strain relief for the float switch cable. Provide a minimum of two mounting brackets for fixing the pipe to the vessel wall while maintaining appropriate standoff distance. The System Manufacturer shall ensure mounting is in accordance with the manufacturer's recommendations.

5. Spare Parts: Provide 2 spare float switches.
6. Acceptable Manufacturers: Equal to Warrick Series M, Anchor Scientific.

D. Magnetic Flowmeter (FE/FIT-100, FE/FIT-200, FE/FIT-300, & FE/FIT-400)

A. Primary Flow Head

1. Electromagnetic flowmeter shall operate on electromagnetic induction principle and give an output signal directly proportional to the liquid rate of flow.
2. Each meter shall have a stainless steel metering tube and a non-conductive liner suitable for the liquid being metered. End connections shall be steel flanged for sizes 1/2" and greater, ANSI Class 150#, for meter sizes up to 24" and AWWA Class B or D for meters larger than 24". The housing shall be epoxy coated steel, welded at all joints. Bolted coil enclosures shall not be acceptable.
3. The field coils of the meter shall be supplied with a precisely adjusted bi-polar direct current.
4. There shall be no electronic components on the primary flow head. Coil drive power shall be supplied by a remote signal converter. Output signal from the primary shall be fed through 'DS' proprietary cable supplied with the meter to the signal converter.
5. Complete Submergence NEMA 6P (IP68) enclosure rating
6. Electrode material shall be compatible with the process fluid.
7. Liner material will be hard rubber.
8. Meter will have field replaceable electrodes with access ports.
9. The instrument shall be manufactured in an ISO 9001 approved facility.
10. When installed in lined or non-metallic piping, the meter shall be provided with corrosion resistant grounding rings. Grounding electrodes shall not be acceptable.
11. Meter calibration shall be performed by a direct volumetric comparison method. A calibration certificate shall accompany each meter. Calibration facility shall be certified to .03% accuracy, and be traceable to national standards.
12. The meter shall be Krohne Model ENVIROMAG series or approved equivalent.

B. Converter for Magnetic Inductive Flowmeter

1. The Magnetic Flowmeter Converter shall be remotely mounted and provide precisely controlled and regulated, bipolar DC primary field excitation pulses at a keyed frequency of 1/6, 1/16, or 1/32 of line frequency digitally selectable. It shall convert the primary flowmeter signal into a 4-20 mA DC output AND a pulse output directly proportional to the flow rate. The 4-20mA output will be used by the master control panel and the pulse output by the Mission Control panel.
2. The full scale measuring range shall be a direct digital input in gpm and fully adjustable over a range from 1.0 to 40 ft/sec.
3. Each converter shall contain self diagnostics, automatic data integrity checking, and be completely interchangeable with other converters of the same type without need for recalibration. No auxiliary test meter or primary simulator shall

be required for commissioning, zeroing, or interchanging of flow meter/converter.

4. Each converter shall contain the following features as standard equipment:
   - Simultaneous analog output (500 ohm load) and a scaled pulse output.
   - Adjustable damping of analog signal from 0.2 to 99 seconds.
   - Low flow cutoff.
   - Forward/reverse flow measurement capabilities
   - Integral rate of flow indicator and 7-digit LCD totalizer
   - Capability of testing analog and frequency outputs.
   - The converter shall be capable of interfacing with an IBM compatible PC utilizing the PC Config software via a RS 232 converter.
   - Ten year data retention without the need for auxiliary power.
   - Engineering units for display and programming; flow and total shall be user programmable in any engineering unit of measure.
   - All adjustments and changes of above features shall be by direct digital input.
   - Repeatability shall be 0.1% of rate.
5. Accuracy of the system (Primary Flow Head and Converter) shall be:

   Meter sizes 3/8” - 24” +/- 0.3% of actual flow rate(for velocities of 1.3 - 40 ft/sec)
   Meter sizes 28” - 40” +/- 0.5% of actual flow rate(for velocities of 0.8 - 40 ft/sec)
6. The enclosures shall be rated NEMA 4X (IP-65)
7. The instrument shall be manufactured in an ISO 9001 approved facility.
8. The converter shall have HART smart protocol. It shall use the HART protocol via FSK transmission along the analog signal wire to remotely configure, read flowrate, total and diagnose problems without affecting the measurement signal. The intelligence must reside within the converter.
9. The signal converter shall be Krohne model IFC020K/F or pre-approved equivalent.

E. Alarm Light (Strobe Type)

1. Type; Heavy duty, corrosion-resistant high intensity strobe warning light.
2. Enclosure: Corrosion-resistant, NEMA 4X, suitable for outdoor service. Unit shall be suitable for mounting in Class I, Group D, Division 2 rated areas.
3. Power: 120 VAC, 60 Hz.
4. Dome Color: Red, blue, or amber, as called for in schedule below.
5. Acceptable Manufacturer: Equal to Federal Signal Corporation (Model 151XST).

F. Alarm Horn

1. Type: Electro-mechanical diaphragm type.
2. Mounting: Provide neoprene gasketed weatherproof housing for out-of-doors mounted units and gasketed panel mounting kit for panel mounted units.
3. Diaphragm Material: Stainless steel.
4. Grille Material: Die-cast aluminum.
5. Power: 120 VAC.
6. Sound Intensity: 90 dB - I 10 dB at 10 feet from unit.
7. Acceptable Manufacturer: Equal to Federal Signal Corporation (Model 350).

G. Gas Detector (AE-150, AE-250, AE-350, & AE-450)

1. General Specifications : Use 3 wire, 4-20mA and RS485 MODBUS output fixed point detector with in-built alarm and fault relays for the protection of personnel and plant from flammable, toxic and Oxygen hazards. Incorporating a transmitter with local display and fully configurable via non-intrusive magnetic switch interface.
2. Electrical: Input Voltage Range 16 to 32VDC (24VDC nominal)
3. Max Power Consumption: Maximum power consumption is dependent on the type of gas sensor being used. Electrochemical cells = 3.7W, IR = 3.7W and catalytic = 4.9W. Maximum inrush current = 800mA at 24VDC
4. Current Output: Sink or source
5. Relays 3 x 5A@250VAC. Selectable normally open or normally closed (switch) and energized/de-energised (programmable). Alarm relays default normally open/de-energized. Fault relay default normally open/energized
6. Communication RS485, MODBUS RTU
7. Construction: Material Housing: Epoxy painted aluminium alloy LM25 or 316 stainless steel. Sensor: 316 stainless steel. Weight (approx) Aluminium Alloy LM25: 4.4lbs 316 Stainless Steel: 11lbs
8. Mounting: Integral mounting plate with 4 x mounting holes suitable for M8 bolts. Pipe mounting kit for horizontal or vertical pipe Ø1.5 to 3" (2" nominal).
9. Cable Entrie: UL versions: 2 x ¾"NPT conduit entries. Suitable blanking plug supplied for use if only 1 entry used. Seal to maintain IP rating; ATEX/IECEx versions: 2 x M20 cable entries
10. Environmental: IP Rating IP66 in accordance with EN60529:1992 Certified Temperature Range 40ºF to +149ºF (-40ºC to +65ºC)
11. Acceptable Manufacturers: Equal to Honeywell Analytical SPXCDULNFX or Draeger equal.

H. Hand Stations:
   a. Typical for:
      i. HS-101, HS-102, HS-103, HS-105B (NC E-Stop)
      ii. HS-201, HS-202, HS-203, HS-205B (NC E-Stop)
      iii. HS-301, HS-302, HS-303, HS-305B (NC E-Stop)
      iv. HS-105B, HS-205B, HS-305B, HS-405B (NC Emergency)
   b. Handstations shall be in a NEMA 6 enclosure.

I. Station Entry Limit Switch (XS-115, XS-215, XS-315, XS-415)
   a. Square D microswitch, 120V with Form C
   b. Mount at door such that switch activates when door opens.

2.02 CABLES

A. INDUSTRIAL TWISTED PAIR (ITP) 100 MB FAST ETHERNET CABLES

1. ITP cable shall be Cat 6E.

2. The ITP cable shall be a standard 9 pin cable with RJ45 type connectors.

3. ITP Cables shall be by Belden.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Instrument Tagging

1. Provide stainless steel identification tags attached with stainless steel wire or screws for all field instruments.

3.2 FIELD QUALITY CONTROL

A. Tests And Calibration

1. Perform continuity and insulation resistance tests on instrumentation conductors.
2. Calibrate each instrument to its published accuracy. Submit calibration sheets including the instrument tag number or name, the date, name of individual performing calibration, procedures and equipment used, and results obtained.

END OF SECTION

SECTION 40 92 00

WIRELESS MONITORING AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install a factory wireless data cellular based communication system for the purpose of monitoring and controlling various equipment operations. The supplier of the communication system shall be responsible for coordination required to insure equipment compatibility. The communication system shall be provided complete, in place, as shown on the Drawings, specified herein and needed for a complete, proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions, and sections in Division 1 of these Specifications.

2. Division 26: Electrical

3. Drawing I-1.1, I-2.1, I-3.1, I-4.1 and E5.2.

1.02 QUALITY ASSURANCE

1.03 SUBMITTALS AND SUBSTITUTIONS

A. The following product data shall be submitted in accordance with the approved Construction Schedule required in these Specifications:

1. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;

2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work;

3. Test data required elsewhere in this Section.

B. Upon completion of this Portion of the Work, and as a condition of its acceptance, deliver to the Engineer six copies of an operation and maintenance manual compiled in accordance with the provisions of these Specifications.

1.04 EQUIPMENT COMPATIBILITY

A. The Contractor shall be responsible for coordinating the instrumentation equipment, communication equipment and other related equipment so that all elements are compatible and form a complete working system. Shop drawing submittals shall include sufficient information regarding component compatibility to demonstrate compliance with this requirement.

PART 2 - PRODUCTS

2.01 GENERAL

. A. Qualifications of Manufacturers Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of satisfactory production acceptable to the Engineer.

1. The submitting Company shall provide evidence of, and warrant compliance with, substantially all below listed requirements.
2. The submitting Company shall have been in business providing remote facility monitoring and control services through the data side of the cellular system to the water distribution / wastewater collection industry or a substantially similar industry for at least six years.
3. The submitting Company shall be the actual manufacturer and operator, or a duly authorized and trained agent of the manufacturing company or a combination of both, who will actually provide, maintain, and warranty the proposed system.
4. The Manufacturing Company of the field equipment shall also be the provider of all monitoring related services associated with the field equipment and all ongoing service agreements will be with the actual company providing the monitoring service, not a subcontractor or agent.
5. The submitting company shall have a primary central monitoring and control center and a fully redundant, physically separate, backup-computer monitoring center. Either center shall have the capability of operating all the remote monitoring and control field RTU's.
6. The submitting Company shall offer and provide 24 X 7 technical support.

2.02 MONITORING AND CONTROL SYSTEM

A. Microprocessor Based Field RTU

1. <u>Data Cellular Radio</u>
   a. The Remote Terminal Unit (RTU) shall incorporate a radio that utilizes the data side of any cellular system to transmit the data and alarms monitored, as well as receive manual or automated control commands.
   b. Cellular radios from all cellular carriers shall be able to mount in the same mounting port on the motherboard and consequently be interchangeable in no more than 10 minutes.
2. <u>Enclosure Options</u>
   The RTU shall be offered in at least the following three enclosure options:
   a. NEMA1 with battery inside the enclosure
3. <u>Microprocessor Feature Updates</u>
   Microprocessor features like data transmission rates shall be able to be adjusted through the cellular system without any site visits necessary.
4. <u>RTU Inputs and Outputs</u>

a. RTU shall have eight (8) digital inputs. These eight (8) inputs must have end of line resistor supervision, or similar supervision, that can detect normal alarm trip inputs and detect input wiring disconnection/shorting as a distinctly different signal and report.
b. RTU shall have include an optional expansion board of an additional eight (8) digital inputs
c. The digital inputs shall be user selectable as normally open (NO) or normally closed (NC).
d. At least eight of the RTU digital inputs must be capable of being programmed to record and report pump run times in one minute increments or less as indicated by a relay opening and closing. If only two pumps are monitored then the unit shall also be capable of recording and reporting simultaneous pump run times.
e. RTU shall have built-in alarms for input wiring fault, AC failure, communication failure and low battery detection.
f. RTU shall have two (2) analog inputs measuring 4-20mA or 1-5 VDC at 10 bit resolution with four (4) alarm thresholds per input.
g. RTU shall have an optional expansion board of an additional four (4) analog inputs
h. RTU shall have an optional expansion board of an additional two(2) analog outputs.
i. RTU shall have an optional expansion board of two (2) pulse counter inputs
j. RTU shall have an electronic key reader input to monitor on-site personnel. The RTU shall utilize an audible tone to verify key reading. Each key in the system shall provide unique identification of the key holder when they are on site vs. “someone” is on site.
k. RTU shall have three (3) digital normally open or closed output relays rated at ½ ampere@ 120VAC.
l. The well RTU (s) shall have the ability to be programmed to either:
    i. Continue the current well call relay status or
    ii. Force off the well call to run status. If the well RTU(s) lose communications with the hosted SCADA service computer(s) for more than two minutes.
m. The output relay(s) from the well(s) RTU shall be wired only into the automatic circuit for well pump(s) run. The local off and hand circuits shall be unaffected by the RTU relay output(s). The output relays on the well(s) RTU(s) shall be wired into 12vdc solid state interposing relays. The switched side of the solid state interposing relay(s) shall be used to control the well(s) pump(s) motor starter in the automatic well call circuit.
n. The system shall have an alarm on pump call to run and fail to run.
o. System shall include the wet well alarm module.

5. <u>Status Lights on Motherboard</u>
    a. indicator lights above each digital input shall visually display the status of the digital input
    b. Radio signal strength shall be displayed by at least 8 indicator lights in 5db increments between -75db and -110db to facilitate accurate antenna placement
    c. Operational and diagnostic status of at least 8 criteria shall be displayed by individual indicator lights.

6. <u>Power Requirements</u>

a. The RTU shall be powered by 12 volts AC and have a built in battery backup capable of keeping the RTU powered for 30 hours in case of primary AC failure.
b. All terminations inside the RTU enclosure shall be low voltage AC or DC (28 volts or less).
c. The Tank and well(s) RTU(s) shall be grounded in accordance with the NEC regulations.

B. Communication Links

1. Communication System
   a. Wireless communication links shall be through the data side of the cellular system. The voice side of the cellular system and satellite based links are not acceptable.
   b. System shall include a 50 foot ultra low loss antenna cable.
2. Cellular Carriers
   a. The submitting company shall have direct relationships with the cellular companies and shall not use third parties to affect data transport through the cellular companies. The general architecture of the system will be based on using third generation cellular data for telemetry and on sending that data to a web based hosted SCADA computer service that manages the entire system except field maintenance.
   b. The RTU will have interchangeable data cellular radios that will communicate through third generation GPRS (ATT), CDMA (Verizon) or iDEN (Nextel) to maximize the likelihood of reliable communication.
   c. If a GPRS (ATT) radio is used, the submitting company shall have PTCRB approval from ATT to use the radio, contract and product acceptance with ATT. If an iDEN radio is used the submitting company shall be have certified partner status, contract and product acceptance with Sprint/ Nextel.
   d. The Customer will not have or have to purchase cellular data contracts direct with the carrier(s).
3. Security Protocols
   a. All the cellular radios shall all make continuous, secure socket connections (SSL) from the radio, through the cellular system, to the submitting company's servers and web pages.
   b. The RTU shall utilize a transmission scheme that encrypts the transmitted data utilizing a 128 bit encryption method that meets or exceeds the advanced encryption standard (AES). The 128 bit AES encryption shall be at all stages of data transfer and storage
   c. The cellular radios shall all have private IP addresses
   d. The submitting company shall have established multiple, private gateways through the cellular system, completely behind firewalls, with at least one of the cellular providers.
4. Data Transmission Rates
   a. All alarms will be transmitted immediately upon occurrence; delays can be added by the customer at the RTU or the supplier's website.
   b. The RTU shall either transmit non-alarm data updates every hour or continuously transmit all digital state changes on an as occurs basis; analog and pulse inputs will be transmitted at least once every two minutes. The customer may choose to utilize either type of RTU at any proposed site.
   c. The RTU will have an effective, continuous, transfer rate of at least 19,200 baud.
5. Communication Link Structure and Performance Criteria
   a. The communication link structure shall be a secure socket connection from the RTU through the cellular system to the supplier's servers, and it shall be a continuous connection, 24 x 7, 365.

b. Receipt of all data sent from the RTU to the server center shall be acknowledged by the server center back to the RTU in real time for every data packet sent. Such structure is called end-to-end data acknowledgement.
c. The secure socket connection shall be from the RTU through the cellular system direct to the system supplier; no third parties shall receive the data from the cellular carrier and then pass it to the system supplier.
d. The above mentioned secure socket connection shall be monitored for end-to-end uptime with interruptions as small as 15 seconds being captured.
e. Both end-to-end uptime and the number of times the link was disconnected/reconnected shall be reported for each RTU continuously with daily summary statistics posted on the customer website. All the end-to-end uptime history of each RTU shall be available on the customer web site from when it first powered up to the present. Weekly management summaries of each RTUs end-to-end uptime shall be automatically emailed to the customer.

C. Centralized Server Centers: Hardware and Software Requirements

1. <u>Server Center Physical Structure</u>
   a. The server center housing shall be able to withstand a direct hit from at least an F-3 tornado and continue operations.
   b. The server center housing shall have at least six (6) separate and redundant, on-site power generating facilities to backup the local utility power such that there can be stand-alone operation of the center for at least 24 hours.
   c. Entrance to the facility shall be controlled by armed guards at all entrances 24x7x365
2. <u>Server Center Redundancy Structure</u>
   a. The server center shall house the manufacturers completely redundant and hot linked:
      i. Servers
      ii. Interconnects
      iii. Databases
      iv. Power supplies
      v. Inbound cellular connections
      vi. Outbound internet hubs and providers
3. <u>Database Structure</u>
   a. All data from the RTU's shall be held for customer access forever.
   b. All databases shall be backed up and archived daily
   c. The hosted system shall have password protected SSL web based customer screens. Automatic control logic for well operation shall be maintained by the hosted SCADA computer service. The hosted service shall monitor, at least every two minutes the level of the tank(s). The hosted SCADA service computer shall issue control relay commands to the associated well(s) when pre programmed low, off, lead, lag, lag 2 and high tank level thresholds are reached. The low, off, lead, lag, and lag 2 and high level thresholds shall programmable by the customer via the secure web site. All threshold changes shall be individually password protected and logged. The secure web site shall also provide the customer the ability to put each well pump(s) in automatic, off or hand operation mode. The secure web site shall provide the customer the ability to enable/disable alternation of the well(s). The hosted well control SCADA service shall provide control for up to three wells from a single tank. Multiple tanks may be depicted and controlled on a single customer secure web site
   d. The databases shall be capable of interfacing and transferring, on a continuous basis, all RTU data to an OPC compliant database for access by other OPC compliant HMI software packages.

i. Client side OPC software will run as an executable or NT service.
ii. Client side OPC software will, on a user definable interval, establish a socket connection to static IP address(s) at providers' server center.
iii. OPC software shall retrieve all changed OPC tag values and close the socket. OPC software shall be set up so as customers OPC computers firewalls may be programmed to only allow Internet traffic to/from the designated service providers IP addresses and port numbers.
iv. OPC software will allow for multiple customer OPC software packages to establish, concurrently, OPC connections so as to provide for redundant HMI database operation at customers locations.
v. Customer's firewalls will not be programmed to accept socket connections.

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4. Field Hardware
   a. The tanks and well(s) SCADA control system shall utilize Mission Communications model M-800 RTUs and SCADA control service or approved equal
   b. The system shall include the installation of a XX (15, 25, 50 or 100) PSI pressure transducer at as close to the base of the tank(s) as possible. The pressure transducer shall be protected from the elements and shall have at voltage surge suppressor able to withstand and discharge a voltage spike of at least 10,000 volts connected to the transducers analog circuit within three feet of the pressure transducer. The surge suppressor and transducer shall grounded in accordance with NEC regulations. The grounding rod shall be within five feet of the surge suppressor. There shall be no bends in the ground wires with less than a 6 inch radius. Straight ground wires are preferred.

5. System Security
   a. All data links shall be behind firewalls, 128 bit encrypted and never accessible, addressable or viewable via the general public Internet, Private IP's are required, pooled public IP's will not be accepted.
6. System Software
   a. The system software shall collect and display:
      i. Alarms including individuals accepting alarms
      ii. the current state to the web service H/O/A operational status (not the well site(s) MCC H/O/A switches), the current values for well pump(s) off, lead, lag and lag 2 thresholds, the current status of well pump alternation, the current status of well(s) call to run and a graphic depicting the current and previous 24-hour tanks level and which well pump(s) were called during fill cycles.
      iii. RTU electronic key reads with user names, time of read, and site name
      iv. pump running status,
      v. pump run times with historical graphs,
      vi. individual pump flow estimates,
      vii. automatic daily analysis of pump runtimes for abnormalities with automatic customer notification of such abnormalities,
      viii. pump starts with hourly analysis of excess pump starts with automatic notifications of excess pump starts,
      ix. minute-by-minute radio health checks with automatic notification of non-reporting or poorly reporting RTU's,

x. scaled and labeled pulse totalizations and if rainfall gauges are used, inter-day rainfall graphs and run time verses rain fall based on either rain gauges installed as part of the system or as run time verses a reporting airport rain gauge;

xi. Utilizing real-time data collection have the ability to based on digital input closure, open or close digital output relay on the same or another real-time unit (Intertie)

D. Alarm System Structure and Software

1. Alarm Delivery Formats
   a. Alarms shall be delivered in the following formats:
      i. Phone (voice call), fax, pager (numeric or alphanumeric (short alpha or long alpha format), text message, email, or any combination of the above simultaneously.
   b. Alarms shall be able to be acknowledged by phone, text message, 2-way pager, email or on the customer web site.
   c. Voice alarm acknowledgement shall be adjustable to be able to mimic the format of dialers.
   d. Alarms will be called out on alarm and upon return to normal conditions.
      i. Return to normal alarms can be adjusted to call the alarm callout group or a different callout group.
2. Alarm Callout Formats
   a. Alarm callout groups shall be able to be setup to automatically switch between callout groups at different hours of the day and/or different days of the week.
   b. Alarm callout groups shall be able to have multiple teams within each group to easily facilitate rotation of teams of on-call personnel.
3. Alarm Message Formats
   a. All alarms shall have the alarm condition, time, alarm location and pump status at the time of the alarm in each message.
   b. Alarm message format shall be adjustable to include just the above information when calling a phone where it is known who will answer the phone, or be adjustable to add an introductory message asking for a specific person when calling a phone where it is not known who will answer the phone (like a home phone).
   c. Alarms shall be able to be delivered individually or be able to be grouped into one message so that multiple, simultaneous alarms (like AC Fail at multiple sites) can be delivered and acknowledged in one phone call.
4. Alarm Dispatch Logs
   a. Each alarm shall have a full log of each notification attempt of that alarm documenting the following:
      i. Date, time, and alarm condition
      ii. If each notification attempt was a success or failure and the reason for each failure if an attempt was a failure (like line busy, call dropped, etc)
      iii. A recording of each voice notification attempt so the specific reason for a notification failure can be known.
      iv. Date, time, and name of person who acknowledged the alarm.
5. Voice Alarm Delivery Capacity
   a. Manufacturer shall provide at least 20 outbound lines to deliver voice alarms so as not delay delivery of current alarms.

E. REMOTE DATA ACCESS

1. Remote Data Access Format

a. Data collected by the system shall be able to be remotely accessed by simple web browser. The system shall provide individual web pages for the User to access via any web browser.

b. To access the web pages, the User will have to enter a User Name and Password.

   i. The User can set up any of three levels of access to the web pages:

      1. Read only…can see but cannot make any changes
      2. Read/Write…can see and can make changes
      3. Read/Write/Control…can see, make changes and effect control functions, also add or remove logins/ passwords.

c. The system supplier will provide at least two separate web sites for each customer. One shall be designed to be viewed on a traditional laptop or desktop computer. The other shall be designed to be viewed on a web enabled cell phone or PDA. This web site will still have graphs showing trending of data, and will be designed to minimize the data sent so as to minimize the page loading times and size of the data plans necessary to view the site on a web enabled cell phone or PDA.

d. The system supplier will provide secure access through a specified phone without the need for web access (Voice SCADA). This will require login to system via numeric 5 digit code and must be set up in the system to an associated login for that site to a specific phone number to maintain site security.

e. In addition to the above web sites, if the User has Mission M800 Real-time RTUs, the User will be provided at no additional charge with a customizable software interface that will display real-time status and graphic trending of data collected by the M800 RTU.

   i. The software will be downloadable from the Mission customer website.
   ii. The software will automatically update itself every time the User accesses the software.
   iii. The software will require NO programming to customize.
   iv. The software will be the Mission Real Time Viewer.

2. <u>Remote Access Security</u>

   a. In addition to the Username and Password structure described above, all access of the User web site shall be logged. Such logging data to included date, time and duration of access, User Name and Password of user to access the site and IP address of the accessing computer. The log will be accessible through the User web site

3. <u>Automated Administrative Reports and Alerts</u>

   a. The User web site shall produce and automatically deliver weekly reports which summarize alarms and responses, pump runtimes and flow estimates, weekly end-to-end uptime percentages of each RTU, and all electronic key uses at the RTU sites.

   b. The web site shall be capable of sending two (2) different categories of notifications, Alarms and Alerts. Alarms are for conditions that the User decides they want to be notified immediately about. Alerts are conditions that need attention, but are not so time sensitive that they cannot wait till the next morning.

      i. The Alarms callout list and the Alert callout list shall be able to be separate and distinctly different.

   c. The User web site shall analyze daily pump run times at compared to a moving 30 day average of that pumps most recent runtimes and automatically Alert the User is the pump runs outside the normal runtime variation pattern.

d. The User web site shall analyze hourly pump runtimes and automatically compare it to two (2) User set thresholds. If the Alert threshold is exceeded, an Alert will be sent the following morning. If the Alarm threshold is exceeded, an alarm will send immediately.

e. The User web site shall send an Alert the first morning that units are in Communications fail even though Alarms have been sent at the time the RTUs went off-line. Such Alerts are a reminder to Management that they still have units that are off line.

2.03 RTU LOCATIONS

A. RTUs shall be located at Sullivan Road Pump Station #1, #2, #3, and #4.

B. RTUs at each location shall be furnished with an omnidirectinal antenna at grade plus 8ft.

2.04 MONITORING POINTS PER RTU

A. The inputs to be monitored at sites are as follows:

1. Digital inputs: 8 Discrete Inputs
2. Digital Expansion Board: 8 Discrete Inputs
3. 2 Analog inputs with four (4) hi/low threshold alarms
4. Analog Expansion Board: 4
5. Pulse inputs: Two Pulses
6. Relay Outputs: Three

2.05 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Additional coordination with the supplier's information here.

3.03 INSTALLATION

. A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer.

B. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.
- If required, the contractor shall adjust the antenna placement or elevation to obtain consistent, stable operation of the system.

C. Delineate timing of RTU installation and commissioning.

3.04 SERVICE

A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for operating and maintaining the equipment, and the contents of the operation and maintenance manual required to be submitted under Article 1.03 in this Section.

B. The Contractor shall furnish to the Owner, through the Engineer, a written report prepared by the instrumentation equipment manufacturer's field service technician certifying that:

1. The equipment has been properly installed in accordance with manufacturer's recommendations;

2. The equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision;

3. Antenna placement has been optimized

4. The equipment is free from any undue stress imposed by connecting conduit or anchor bolts;

5. The equipment operates satisfactorily and in compliance with the requirements of this Section.

C. If applicable, delineate whether or not the Contractor shall include with his bid, the on-site services of the instrumentation equipment manufacturer's field service technician, and for what period. This service shall be for the purpose of instruction of plant personnel and testing of the system.

END OF SECTION

SECTION 40 95 13

PROCESS CONTROL PANELS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to fabricate, complete and ready for operation, the panels depicted on the Drawings and in the Panel List below.

B. All work in this Section shall be the product of the Process Instrumentation and Control Supplier (PICS). Sub-suppliers and/or manufacturers may provide components, enclosures and/or fabrication services to the PICS, but the final product shall conform to this specification and shall be the sole responsibility of the PICS.

1.2 RELATED WORK

A. See Electrical Drawings

1.3 SUBMITTALS

A. Submittals shall be prepared and transmitted to the Engineer for approval in compliance with these specifications. In addition, shop drawings shall include the following information:

1. Materials for all panels and enclosures.

2. Drawings shall be prepared on 11” by 17” paper, shall be to scale and shall show the location of panel mounted devices as well as doors, louvers and sub-panels.

3. Drawings shall include a panel legend and a bill of materials.

4. The panel legend shall list and identify front of panel devices by their assigned tag numbers, nameplate inscriptions, service legends and annunciator inscriptions.

5. The bill of materials shall list devices mounted within the panel that are not listed in the panel legend and shall include the tag number, description, manufacturer and model number for each item.

B. Interconnecting Wiring Diagrams

1. Provide interconnecting wiring diagrams showing electrical connections between panels, consoles, terminal junction boxes and field mounted components.

2. Diagrams shall show component and panel terminal identification numbers and external wire and cable numbers.

3. Circuit names corresponding to the Conduit Schedule shall be shown.

4. These diagrams shall be coordinated with the Electrical Subcontractor and shall bear his mark showing that this has been done.

5. Diagrams shall show all field connecting devices including solenoid valves, pressure switches, and limit switches.

1.4 SYSTEM DESCRIPTION

A. The PLC based panels shall be the same size as the existing control panels being replaced. See electrical drawings for dimensions.

B. The following PLC based panels shall be furnished by the PICS as specified under this Section. Refer to the drawings for size, location and contents of each panel.

LCP No.	LOCATION	ENCLOSURE
MAIN CP LCP-100	Sullivan Road Pump Station No. 1	Nema 12
MAIN CP LCP-200	Sullivan Road Pump Station No. 2	Nema 12
MAIN CP LCP-300	Sullivan Road Pump Station No. 3	Nema 12
MAIN CP LCP-400	Sullivan Road Pump Station No. 4	Nema 12

1.5 DELIVERY, STORAGE AND HANDLING

A. The panels and consoles shall be mounted on wood skids four inches high. Adequate crating shall be provided to protect the panels or consoles from damage during shipping.

B. Instruments and components shall be blocked and tied down to prevent damage during shipping. Front-panel mounted instruments or components shall be removed or securely protected from damage during shipment. Items removed from the panels shall be repacked in their original containers and shipped with the panel.

C. Accessories, drawings, instruction bulletins, etc. shall be packed and shipped with the associated panel.

1.6 SPARE PARTS AND TEST EQUIPMENT

A. Provide spare parts and test equipment as indicated below.

1. Fuses: 20 percent of each size and type used, but no less than ten of each size and type.

2. Relays: 10 percent of each type used, but no less than five of each type.

3. Indicating Light Bulbs: 25 of each size and type used.

4. DC Power Supplies: 20 percent of each size and type used, but no less than two of each size and type.

5. Five spare pilot indicating lights, rotary hand switches, pushbuttons of each type used.

6. One spare analog indicator of each type used.

7. Corrosion Inhibiting Vapor Capsules: Provide 20 of each type and size used.

B. All spare parts shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature.

PART 2 - PRODUCTS

2.1 CONTROL PANEL GENERAL REQUIREMENTS

A. Furnish and install the panels per the Specifications and Drawings, meeting the space limitations as shown in the Contract Drawings.

B. The construction and wiring for the panels shall be in accordance with this Specification and applicable panel drawings. The panel drawings will specify the arrangement of instruments to be mounted on the front, rear and sides of the panels.

C. All panels shall be fully enclosed for use with high-density instrumentation mounting.

D. All panel doors shall have a lock installed in the door handle, or a hasp and staple for padlocking. Locks for all panels provided under this Contract shall be keyed alike.

E. The instruments and equipment designated for rear-of-panel mounting shall be arranged within the panel according to associated panel drawings in a manner to allow for functionality, ease of maintenance and adjustment.

F. Conductors running from the field to the panels shall be continuous without splices, except at approved junction boxes. All junction boxes and panels shall have 20 percent spare terminals.

G. Conduits and cables entering panels shall be sealed to prevent the intrusion of gas and moisture.

H. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates, in such a manner that the component may be removed without removing the plate and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required by the manufacturer to protect equipment from vibration. Mounting orientation shall be in accordance with the requirements of each component.

I. Components shall be identified with suitable plastic or metal engraved tags attached adjacent to (not on) each component identifying the component in accordance with the Drawings, Specification and PICS data.

J. The internal framework of each panel shall permit panel lifting without distortion. Provide removable lifting rings designed to facilitate simple, safe rigging and lifting of the panel during installation. Plugs shall be provided and shall unobtrusively fill the panel lifting ring holes when substituted for the lifting rings after installation is complete.

K. All panels, consoles and exterior mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.

L. All panels shall be supplied with suitable nameplates, which identify the panel and individual devices as required. Nameplates shall be provided for all flush mounted

equipment in the interior and exterior of each panel. Nameplates shall be constructed of white and black laminated phenolic material having engraved letters extending through the white face into the black layer. Nameplate shall be beveled and attached to panels by adhesive or glue.

2.2 PANEL MATERIALS AND CONSTRUCTION

A. General

1. All panels located in indoor areas, unless otherwise specified, shall be NEMA 12 construction.

    a. Freestanding panels shall be constructed of 12 gauge or thicker steel, suitably braced internally for structural rigidity and strength. All exposed welds, seams or edges shall be ground smooth.

    b. Wall or Unistrut mounted panels shall be constructed of 14 gauge or thicker steel. All exposed welds, seams or edges shall be ground smooth.

    c. Front panels or panels containing instruments or components shall be 10 gauge or thicker sheet steel reinforced to prevent warping or distortion.

    d. Interior panels of 10 gauge steel construction shall be provided where necessary for instrument or component mounting.

    e. All doors shall be lockable, mounted with strong, continuous, piano type hinges and shall be provided with door handles and three point latches or screw clamps.

2. All panels located in outdoor areas, or in indoor areas where otherwise specified, shall be NEMA 4X Type 316 stainless steel construction.

    a. Freestanding panels shall be constructed of 12 gauge or thicker Type 316 stainless steel, suitably braced internally for structural rigidity and strength. All exposed welds, seams or edges shall be ground smooth.

    b. Wall or Unistrut mounted panels shall be constructed of 14 gauge or thicker Type 316 stainless steel. All exposed welds, seams or edges shall be ground smooth.

    c. Front panels or panels containing instruments or components shall be 10 gauge or thicker Type 316 stainless steel reinforced to prevent warping or distortion.

    d. Interior panels of 10 gauge steel construction shall be provided where necessary for instrument or component mounting.

    e. All doors shall be lockable, mounted with strong, continuous, piano type hinges and shall be provided with door handles and three point latches or screw clamps.

3. Panels shall be provided with full length, fully gasketed rear doors or front access doors as shown on the panel drawings. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments or control devices.

4. The panel shall be suitable for top or bottom conduit entry as required by the Electrical Drawings.

5. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts or other accessories as required to maintain the NEMA rating of the panel and the electrical rating of the conduit system.

B. Finish Requirements

1. All panel sections shall be descaled, degreased, filled, ground and finished. The enclosure, when fabricated of carbon steel, shall be furnished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane or lacquer finish, which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel and fiberglass-reinforced polyester panels will not require a paint finish.

2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with solvent. Surface voids shall be filled and ground smooth.

3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sanding shall be applied to the intermediate exterior coat before the final top coat is applied.

4. The panel interior shall have a minimum of two coats of flat white lacquer after priming.

5. Unless otherwise noted, the finish exterior colors shall be selected by the Owner from color chips supplied by the PICS.

C. Manufacturers

1. The panels shall be manufactured by Hoffman or Engineer approved equal.

2.3 INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. Panel equipment and components shall be mounted and wired on or within the panel or console. Wiring shall comply with the National Electric Code. Wiring within the panel shall be grouped together with wire ducts and secured to the structure. Wiring shall be numbered in compliance with the numbering system used on the wiring / connection diagrams. Wiring and connection diagrams shall comply with ISA S5.4 Instrument Loop Diagrams and shall be as part of the Shop Drawings for review by the Engineer.

2. Power wires shall be 14 AWG Type THWN stranded and shall be insulated for not less than 600 volts. Conductors shall be of tinned copper construction. All interconnecting wiring, except for electronic circuits, shall be rated for not less than 90^0 C.

3. Control wires shall be 16 AWG Type THWN stranded and shall be insulated for not less than 600 volts. Conductors shall be of tinned copper construction. All interconnecting wiring, except for electronic circuits, shall be rated for not less than 90^0 C.

4. Analog signal cables shall be single pair 16 AWG shielded cable with a ground wire. Conductors shall be of tinned copper construction.

5. All wiring leaving or entering the panel shall be terminated on terminal blocks that are rigid, numbered and located for ease of access and troubleshooting.

6. Terminal strips shall be separated into groups for power, control and analog signals.

7. Terminal strips and/or block systems shall be manufactured by Phoenix, Allen Bradley or Weidmuller and shall be rated for a minimum of 600 volts.

8. Wire ducts for supporting internal wiring shall be a plastic type with snap on covers.

9. Each wire shall be provided with a numbered and typed heat shrink tubing identification marker at both ends. Handwritten markers or paper markers will not be permitted. Each individual wire shall be assigned a number that corresponds to the number shown on the Drawings.

10. Each freestanding panel shall have a switched single-tube 20 Watt fluorescent light fixture mounted internally in the ceiling of the panel manufactured by Hoffman.

11. Each panel shall have a duplex convenience receptacle mounted internally within the panel in an appropriate steel box and cover.

12. A single lamp test button shall be provided on a panel, where appropriate, to test all of the indicator lamps in the panel at the same time.

13. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Grounding shall be in accordance with the instrumentation manufacturer's recommendations.

14. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the National Electric Code.

15. Each panel shall be provided with analog signal isolation (I/I) when analog signals are sent from one panel or console to another.

16. Each panel shall be provided with surge suppression protection (electrical transients) for connections between AC power systems and electrical or electronic equipment. Surge suppressor grounding shall be in accordance with the manufacturer's recommendations.

17. Each panel shall be provided with a circuit breaker power disconnect switch.

18. Each digital output shall be wired to an interposing relay and one normally open contact from each relay shall be wired to the terminal strip. The contact shall be rated for 115 VAC, 10 Amp or 24 VDC, 10 Amp.

B. Print Storage Pockets

1. Print storage pockets shall be provided on the inside of each panel or console. Its size shall be sufficient to hold all of the prints and documentation necessary to service the equipment attached to it or within it.

C. Equipment Shelves

1. Equipment shelves shall be provided as necessary to support miscellaneous equipment that is normally not mounted or fastened directly to a panel.

a. Ethernet Switches

2. Shelves shall be fabricated out of aluminum sheet metal and shall be fastened securely to the equipment panel within the enclosure.

2.4 MISCELLANEOUS PANEL COMPONENTS

A. Panel Meter - Digital Readout

1. Type

a. Numerical digital process meter.

2. Functional Performance

a. The meter shall be a 3-½ digit minimum resolution LED indicator and shall display the value of the analog input signal in engineering units with a scaled range, as noted. The decimal point shall be field selectable and the meter shall provide an over range indication.

b. Accuracy shall be 99.9 percent.

c. Power requirements shall be 120 VAC or 24 VDC, as required.

d. The operating temperature limits shall be 0 to 60^0 C.

3. Physical

a. The meter shall be housed in a NEMA 4X high impact plastic enclosure with a splash proof lens.

b. The meter shall provide a permanent service legend to display the engineering units of the process variable.

c. The meter dimensions shall not exceed 4” wide x 2” high x 5” deep.

4. Manufacturers

a. The digital readout panel meter shall be Model PD690 as manufactured by Precision Digital or Engineer approved equal.

B. Pilot Indicating Lights

1. Type

a. LED Type Lamps

2. Functional Performance

    a. Units shall be provided with low voltage lamps suitable for 24 VDC power.

    b. Lights shall be push-to-test type.

    c. Lamps shall be replaceable from the front of the unit.

3. Physical

    a. Lens colors shall be as indicated on the Drawings and shall be approximately 1 ¼ inch in diameter.

    b. Provide legend nameplates engraved to indicate the required function of each device.

    c. Units shall be rated NEMA 4X for outdoor weatherproof conditions.

4. Manufacturers

    a. The pilot indicating lights shall be Model 800T as manufactured by Allen Bradley or Engineer approved equal.

C. Rotary Hand Switches and Pushbuttons

1. Type

    a. Control devices shall be heavy-duty oil tight type with stackable contact blocks.

2. Functional Performance

    a. Provide control devices, switch configurations as required for the control system specified and as shown on the Drawings.

3. Physical

    a. For 115 VAC service, provide contacts rated 10 Amps at 115 VAC, for 24 VDC service provide contacts rated 5 Amps at 125 VDC, for electronic (millivolt / milliamp) switching provide gold plated contacts rated at 28 VDC.

    b. Pushbuttons shall have flush type operators and selector switches shall have knob or wing lever operators.

    c. Provide legend nameplates engraved to indicate the required function of each device.

    d. Units shall be rated NEMA 4X for outdoor weatherproof conditions.

4. Options / Accessories Required

    a. Provide lockout pushbuttons, key-operators, etc. as indicated on the Drawings.

b. Provide make-before-break bridging contacts as required for the control system specified.

5. Manufacturers

a. The rotary hand switches and pushbuttons shall be Model 800T as manufactured by Allen Bradley or Engineer approved equal.

D. General Purpose Relays and Time Delay Relays

1. Type

a. Units shall be general-purpose plug-in type.

2. Functional Performance

a. Provide general-purpose control relay and time delay relay configurations as required for the control system specified and as shown on the Drawings.

b. Mechanical life expectancy shall be in excess of 10 million operations and the duty cycle shall be rated for continuous operation.

c. Relays shall be provided with an integral indicating light to display when a relay is energized.

d. Solid-state time delay relay periods shall be 0.1 second to 4.5 hours and shall be adjustable, provided with polarity protection and transient protection.

3. Physical

a. For 115 VAC service, provide contacts rated 10 Amps at 115 VAC, for 24 VDC service provide contacts rated 5 Amps at 125 VDC, for electronic (millivolt / milliamp) switching provide gold plated contacts rated at 28 VDC.

b. Relays shall be provided with dust and moisture resistant covers.

4. Options / Accessories Required

a. Provide all mounting rails, mounting sockets, etc. that are required.

5. Manufacturers

a. The general-purpose relays and time delay relays shall be Model 700HF as manufactured by Allen Bradley or Engineer approved equal.

E. Signal Isolators / Boosters / Converters

1. Type

a. Solid-state electronic type.

2. Functional Performance

a. Provide signal isolators, boosters or converters as required for the control system specified and as shown on the Drawings.

b. Accuracy shall be 0.15 percent or better.

c. Inputs shall be current, voltage, frequency, temperature or resistance as required.

d. Outputs shall be current or voltage as required.

e. Isolation shall be complete between input circuitry, output circuitry and the power supply.

f. Zero and span adjustments shall be provided.

g. RFI protection shall be provided.

3. Physical

a. Units shall be suitable for mounting in a rack or an enclosure.

b. Units shall be provided with dust and moisture resistant covers.

4. Options / Accessories Required

a. Provide all mounting rails, racks, etc. that are required.

5. Manufacturers

a. The signal isolators / boosters / converters shall be Series 4000 as manufactured by AGM or Engineer approved equal.

PART 3 - EXECUTION

3.1 Installation

A. The panels shall be factory tested and approved by the Engineer prior to shipment.

B. The panels and consoles shall be installed at locations as shown on the Drawings.

END OF SECTION

SECTION 41 22 33
HOIST SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete design and installation of electric wire rope hoist systems. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations.

B. Contractor shall supply all parts, devices and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the equipment being furnished. All costs associated with such changes and adjustments shall be considered as being included in the price bid for the Work shown and specified.

C. Related Work specified elsewhere:

1. Section 051200: Structural Steel.

2. Section 099400: Shop Painting.

3. Section 099410: Field Painting.

4. Section 260000: General Electrical Provisions

5. Section 260519: Wire and Cable

1.2 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the Section 013300. In addition, the following specific information shall be provided:

1. Make, model, weight, and horsepower of each equipment assembly.

2. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.

3. Detailed structural and mechanical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.

4. External utility requirements such as air, water, power, drain, etc., for each component.

5. Date on material and equipment.

6. Shop drawings including complete electrical and control diagrams.

7. Manufacturer's certification in accordance with accepted design data.

8. Test data to support certification.

9. O&M Manuals.

B. Written calculations and other data demonstrating that the equipment provided under this Specification has been amply designed and suitable for these service conditions.

C. Relevant experience references. Provide a list of at least five (5) similar installations in the United

States, with installation description, contact names, addresses, and telephone numbers.

D. List of recommended spare parts.

E. Recommended procedure for protection and storage of equipment prior to installation.

F. Operation and maintenance manuals. These shall include a complete bill-of-materials listing all equipment and spare parts.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

1. NEC: National Electric Code.

2. NEMA: Standards of National Electrical Manufacturers Association.

3. OSHA: Occupational Safety and Health Act.

4. ANSI: American National Standards Institute.

5. ASME: American Society of Mechanical Engineers

6. ASTM: American Society for Testing Materials.

7. AISI: American Iron and Steel Institute.

8. NFPA: National Fire Protection Association.

9. MMA: Monorail Manufacturer's Association.

B. Experience: Equipment furnished under this Section shall be of a design and manufacture that has been successfully used in similar applications. The manufacturer shall have furnished equipment for a minimum of five similar applications. Provide a list of such installations complete with installation description contact names, addresses, telephone numbers. This reference list shall be submitted with the shop drawings.

1.4 QUALITY STANDARDS

A. The wire rope hoists shall be furnished and installed by a single supplier who shall assume sole responsibility for providing complete, operating system designed for long life with a minimum of required maintenance meeting the requirements specified herein and as shown on the Drawings.

B. Manufacturer shall provide written certification that the equipment provided under this Specification has been amply designed and is a suitable application for these service conditions.

C. Manufacturer's offering products that comply with these Specifications include

1. Coffing Hoists.

2. ACCO Wright, York, PA.

3. Or approved equal.

1.5 WARRANTY

A. Provide a warranty against defective equipment and workmanship in accordance with the

requirements of Section 017700.

1.6 STORAGE

A. Manufacturer to provide recommendations on storage of hoist system equipment. All hoist equipment and accessories shall be stored and protected in accordance with manufacturer's recommendations.

1.7 MANUFACTURER'S SERVICES

A. Furnish the services of a factory representative, having complete knowledge of the operational and maintenance requirements and adjustments of the system, for one 8-hour day. The factory representative shall instruct the County's personnel in the proper operation and adjustments of the equipment. The day shall be in addition to any installation time and designated by the Engineer.

PART 2 – PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Material: Ductile Iron

B. Capacity: 2 tons.

C. Lift: 35 feet.

D. Lift speed: 21 feet per minute.

E. Motor: Single speed, 2 HP, 3 phase.

F. Voltage: 230/460

G. Control: NEMA 3R Pushbutton

H. Control Cord: 31 feet

I. Reeving: Single

J. Brake: Disc Motor

K. Clutch: Overload Limiting

L. Thermal Protection: Thermal Overload Protection

M. Lubrication: Oil Bath Gear

N. Beam Height: 6 to 18 inches

O. Beam Width: 3.33 to 7 inches

2.2 TROLLEY

A. Trolley: The trolley shall be underhung and manually operated, designed to move at 35 fpm.

B. Trolley Frame: The trolley frame shall be built of ductile or steel structural shapes and welded into a stable assembly of sufficient strength to comply with general strength requirements and to provide proper wheel and bearing alignment for trolley wheels during the life of the trolley hoist.

C. Trolley Gearing: All trolley gears shall be precision-machined of alloy steel and run in an oil bath for quiet operation. The gear train shall provide for a minimum service of 4,000 hours compounded for intermittent operations corresponding to 5 years' minimum industrial use.

2.3 HOISTS

A. Provide underhung, motorized, trolley hoists having single reeving.

B. Gear Train: The gear train shall consist of quiet running, compact helical gearing and external spur drum gear all enclosed in the same oil-tight housing. All gearing shall be machine cut, heat treated alloy steel with shock-resistant ductile cores. Gearing shall be designed for maximum life and shall operate in an oil bath. The housing shall provide rapid dissipation of heat.

C. Bearings: Precision heavy-duty ball bearings shall support all shafts. All bearings shall be either splash-lubricated or lifetime pre-lubricated and sealed with a minimum Ll0 rating of 10,000 hours.

D. Drum: The drum shall be a steel drum with deep machined grooves. At least 2 full turns of rope shall remain on the drum at the lowest rated hook position. Drum shall have right and left hand grooves for true vertical lift and be fitted with flanges to prevent jamming of the wire rope. Drum pitch diameter shall be at least 18 times the diameter of the wire rope.

E. Mechanical Load Brake: The hoist design shall incorporate an automatic, multiple disc brake capable of holding the rated load independent of the motor brake. This brake shall assure that the load does not accelerate while being lowered. No wear compensation adjustment shall be required.

F. Hoist Motors: The hoist motors shall be 230/460-volt, 60-Hz, 3-phase power, capable of a lift speed of 21 fpm. The motor shall have a standard NEMA shaft extension. Horsepower shall be 2 HP.

G. Motor Brake: The motor brake shall be disc brake and shall provide rapid stops with a minimum of hook drift. The brake shall be rated at a minimum of 150 percent of rated load motor torque.

H. Protective Devices:

1. An electrical interlock shall prevent the motor from operating against the motor brake.

2. A gravity-type upper travel limit switch shall be provided. The unit shall be equipped with an automatic momentary lowering circuit.

3. An overload cutoff shall interrupt the raising circuit when the hoist is overloaded. The cutoff shall automatically reset when the overload condition is corrected.

4. The hoist shall have automatic reversing circuits in each direction of hook travel, which will stop the motor if run-out of the hook exceeds an adjustable preset value.

2.4 HOIST CONTROLS

A. Hoist and Trolley: Pendant control having momentary contact pushbuttons with a device, which will disconnect motors from line on failure of power. Device shall not permit any motor to be restarted until controller handle is brought to the OFF position, or a reset switch or button is operated. Pendant shall be rated NEMA 3R.

B. Pushbuttons: Fully magnetic, plain reversing type, housed in enclosure with contactors of sufficient size and quantity for starting, accelerating, reversing, and stopping duty for specified hoist service class.

C. Hoist and trolley controller shall accept a normally closed isolated contact that will open to disconnect power to both the trolley and hoist.

2.5 ELECTRIFICATION

A. Furnish electrical equipment including motors, motor starters, pendant control, control systems, wire, and conduit.

B. Electrical: In accordance with NFPA 70, NEC Article 610.

C. Grounding: External in accordance with NFPA 70, NEC Article 250.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall furnish and install all electrical work and equipment required for a complete and operable installation..

3.2 PAINTING

A. All surfaces shall be prepared, shop primed and factory painted as part of the work under this Section. Surface preparation, shop priming and painting is specified in the Section 099410, Field Painting.

3.3 TESTING

A.All structural steel welds and bolted connections shall be tested in accordance with the requirements of Section 051200, Structural Steel.

END OF SECTION

SECTION 44 42 56

DRY PIT SUBMERSIBLE WASTEWATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for submersible wastewater pumps. Pump types included in this section are:
1. Dry pit.

B. Unit Responsibility:
1. The work requires that the equipment specified herein shall be complete with all accessories and appurtenances, and shall be the end product of one responsible system manufacturer or responsible system supplier.
2. The Contractor shall obtain each system from the responsible supplier of the equipment. The Supplier shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features, and functions.
3. The Contractor is responsible for ensuring that new equipment is fully compatible with existing equipment and that the entire facility is fully functional.

C. Related Sections include the following:
1. Division 01 Section "Closeout Procedures" for warranty submission requirements.
2. Division 01 Section "Project Record Documents" for post construction requirements.
3. Division 26 Electrical sections for electrical requirements.
4. Division 40 Process Integration sections for instrumentation equipment.

1.3 DEFINITIONS / STANDARDS

A. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
1. Hydraulic Institute (HI)
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters Laboratories (UL).
6. National Electrical Code (NEC).

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: Complete engineering data including, but not limited to, descriptive data, material specifications, pump performance curves, mass moment of inertia calculations for the impeller, motor performance data, piping diagrams, and wiring diagrams. Differentiate between manufacturer-installed and field installed wiring.

B. Characteristic pump performance curves: Submit to the Engineer for approval prior to beginning fabrication of the pumping units.

C. Certified pump performance curves: Submit to the Engineer for approval prior to shipping the units.

D. Characteristic and certified performance curves shall depict, at a minimum, the following information:

1. Head (Ft.) vs. Capacity (GPM).
2. Pump Speed (RPM).
3. Impeller diameter (In.)
4. Diameter (In.) of largest spherical solid that can be passed.
5. Area (Sq. In.) of the eye of the impeller.
6. Clearly marked operating points.
7. Power requirements (HP).
8. Shut-off head (Ft.).
9. Kilowatt (kW) usage at design conditions.
10. Net positive suction head (NPSH) requirements.
11. Efficiency (%) at design conditions.
12. Combined weight of pump & motor.

E. Shop Drawings:

1. Complete layout and connection drawings for pumping systems, including plan, elevation, sections, and details. Include setting drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.
2. Control panel schematics and layout drawings.
3. Descriptive literature and catalog cut sheets.
4. The Contractor shall, in writing, call to the Engineer's attention any deviations that the submittal has from the requirements of the Contract Drawings and Specifications.

F. Operation and Maintenance Data: Provide O&M manuals for pumps as specified in Division 01 and in “Operation and Maintenance Manuals” article of this specification.

G. Manufacturer’s Certification: Provide a certification by a qualified representative of the pumping system manufacturer that the equipment is installed properly, operating within the design parameters, and will be warranted as specified herein. Certification shall be based on a detailed inspection of the installation following the successful start-up of the systems.

1.5 QUALITY ASSURANCE

A. All pumps shall be of approved design and products of manufacturers who have built equipment of similar type, size, and capacity.

B. The supplier shall furnish a completely automated, operable pumping system, including submersible pumps and motors, submersible power and monitoring cables, pump discharge elbows, pump guide rail systems, control systems and all appurtenances and accessories as shown on the Drawings and specified hereinafter.

C. When a pressure transducer style pump control system is provided, an emergency back-up float system shall also be provided.

D. The Contractor shall provide all labor, materials, equipment, and method of installation necessary to complete the work.

E. The work shall be complete with installation of pumps, electrical work, connecting piping, and appurtenances, as shown on the Drawings and specified hereinafter.

F. Telemetry system connection is required as part of the work, provisions shall be made for connection to the existing telemetry system.

G. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on specific manufacturer type and model indicated.

H. Additional Submittals: The Contractor shall submit, upon request, any additional information that the Engineer may deem necessary to determine the ability of the proposed manufacturer to produce the specified equipment.

I. Pump Performance Testing:
1. Notify Engineer at least 30 days prior to date scheduled for performance tests.
2. Perform certification tests on the actual assembled pumps to be supplied.
3. Perform factory tests on each pumping unit in the manufacturer's facility and in accordance with applicable standards of the Hydraulic Institute to demonstrate compliance with specified requirements.
4. Certification tests shall be performed over an operating range from shut-off head to a minimum of 20 percent beyond the specified design performance capacity. Certification tests shall be conducted on each pump being supplied.
5. A pump curve shall be generated showing actual flow, head, BHP, and hydraulic efficiency for each pump being supplied.
6. A registered Professional Engineer shall certify each pump curve.
7. Engineer to witness all pump performance tests.

J. Materials, pumps and installation shall comply with federal, state and local code requirements, including any requirements of authorities having jurisdiction.

K. Verify that specified equipment does not exceed space allocation, and provide the manufacturer Plans as necessary.

L. Replacement Parts Capability: Pump station components shall be the products of manufacturers who can produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time within the expected life of the components.
1. Upon request, the Contractor shall submit full details of the proposed component manufacturer's ability to promptly fill replacement orders.

M. Manufacturer Information: All manufacturer information required by the specifications shall be submitted by the Contractor within thirty (30) calendar days of the date of receipt of the Notice to Proceed.
1. Any additional information or data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described hereinbefore), shall be submitted by the Contractor within fourteen (14) calendar days of the receipt of the written request therefore, unless otherwise specified.
2. Approval of manufacturers will not be given until all information required by the specifications or requested by the Engineer has been submitted and acceptable.

N. Disqualification of Manufacturer:
1. Failure to successfully comply with the provisions of this paragraph will constitute grounds for disqualification of the pump manufacturer.
2. Poor performance of similar pumps in operation under the specified conditions of service, constitute grounds for disqualification of the pump/pump station manufacturer unless such poor performance has been corrected.

O. Experience:
1. The pump(s) shall be the product of a recognized manufacturer whose personnel have been regularly engaged in the design and manufacturing of such equipment for a minimum of 10 years. The manufacturer must be able to demonstrate

experience with the design, fabrication, supply and successful operation of pumps of similar size and capacity. The manufacturer/supplier shall demonstrate upon the request of the engineer that:

2. They maintain a reasonable stock of spare parts for this equipment.
3. They employ sufficient qualified technical personnel to insure adequate servicing and operational control advice covering hydraulic, mechanical, and electrical optimization of pump station procedures and practices.

P. Alternate Manufacturers:

1. The Drawings and Specifications use Fairbanks Morse as the "basis of design equipment". Additional acceptable pump manufacturers include ITT Flygt and Morris Pumps. This is not intended to restrict competition or rule out comparable competitive alternate pumps that may have certain superior or inferior features not affecting the basic operation of the equipment, but is for the purpose of establishing the desired standard of quality and features.
2. The Engineer will not provide new Drawings for construction showing alternate pumps. Manufacturers of alternate pumps shall provide revised Drawings to the Contractor. The revised Drawings will be amendments to the Construction Documents and will become part of the Contract Documents. Change Orders will not be issued to pay the cost of the changes necessary for use of an alternate pump. Contract time will not be increased for the use of an alternate pump.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's rigging instructions for handling.

1.7 WARRANTIES AND BONDS

A. Provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Division 01.

B. The equipment manufacturer warranty shall be against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall end five years from the date of Substantial Completion. The warranty shall be in printed form and apply to all similar units.

PART 2 - PRODUCTS

2.1 GENERAL

A. Supports and Thrust Blocks: All pipes connected to the pump station shall be supported to prevent piping loads from being transmitted to the pumps. Pump station discharge force main piping shall be anchored with thrust blocks and supports where shown on the Contract Drawings.

B. Pipe, Fittings, and Valves: All inside (pumping station and valve vault) piping shall be flanged ductile iron with threaded flanges in accordance with ANSI A21.15, latest revision, or seamless schedule 40 carbon steel with malleable iron fittings. All piping shall be rated for a minimum of 150 psi and shall have ring gaskets, 1/8 inch thick. Ductile iron pipe and fittings shall be in accordance with Division 33 Section "Ductile Iron Pipe and Fittings".

1. Check valves shall be provided on the discharge line between the pumps and plug valves as shown on the Drawings.

2. Check valves shall be wafer type, bronze fitted, have external arms to facilitate draining/back flushing of lines, and shall be as supplied by the pump station manufacturer. The valve clapper shall swing completely clear of the waterway when the valve is open permitting a "full flow" thru the valve equal to nominal pipe diameter.

C. Running Time Meters: A running time meter shall be supplied for each pump to show the number of hours of operation. The meter shall be enclosed in a dust and moisture-proof molded plastic case. The flush mounted dial shall register in hours and tenths of hours up to 99999.9 hours before repeating. The meter shall be suitable for operation on 120V AC supply.

D. Gauges: Each sewage pump shall be equipped with 4-inch indicating gauges to be mounted in the discharge line between the pump and the check valve. The gauges shall have graduated scale reading from 0 to 250 feet. The gauges shall be provided with cutoff cocks and brass pipe connections. Gauges shall have C510 Grade A phosphor bronze bourdon tubes with silver bronzed brass tipped, black and white luminated phenol dials, micrometer adjustment of pointers shall be liquid filled, and shall be diaphragm sealed. They shall be the first grade of the manufacturer, and shall be Ashcroft "Dura-Gauge Type 1379", or approved equal.

2.2 PUMP CRITERIA

A. Provide complete pumping units designed to comply with the following pump criteria:

1. Duty Point:1500 GPM @ 129' TDH
2. Maximum Pump Speed: 1800 RPM
3. Maximum Motor Horsepower: 85 HP
4. Minimum Shut-off Head: 225 Feet
5. NPSH Required at Duty Point: Max 20 Feet
6. Minimum Pump Efficiency at Duty Point: 70%
7. Minimum Impeller Eye Diameter: 4 Inches
8. Cooling Jacket: Yes
9. Number of Pumps Required: 12 (3 pumps per station)

B. Pumps shall be model NT3301 HT, dry pit pumps as manufactured by ITT Flygt, or approved equal, modified as required to meet the specified requirements.

C. Duty point shall fall within 70% to 120% of the pump Best Efficiency Point capacity.

2.3 SUBMERSIBLE WASTEWATER PUMPS, GENERAL

A. Description: Factory-assembled and -tested, heavy-duty, centrifugal dry pit units, close-coupled (as applicable) with submersible electric motors, capable of pumping raw, unscreened sewage and wastewater, fully guaranteed for the application, and constructed for permanent installation.

B. The entire pumping system, including the pump, motor and power cable, shall be approved for use in areas classified as hazardous locations in accordance with the NEC Class 1, Div. 1, Group C and D service as determined and approved by a U.S. nationally recognized testing laboratory (e.g. U.L., FM, CSA) at the time of the bidding of the project. As required by Factory Mutual (FM) the motor shall be capable of operating in pumped media up to 104 degrees Fahrenheit. Motor thermal switches shall monitor and protect the motor from excessive temperature.

C. Pumps shall operate at specific speeds below the “Upper Limits of Specific Speeds” established by the Hydraulic Institute to minimize the potential for cavitation.

D. Pumping system components shall not contain asbestos.

2.4 PUMPING SYSTEM DESIGN

A. Submersible power cable shall be of adequate length to accommodate the pumping system installation as shown on the Drawings, sized according to NEC and ICEA standards, P-MSHA approved.

B. Each pump shall be provided with adequate length of lifting chain or stainless steel cable. The capacity of the lifting system shall be a minimum of 50 percent greater than the combined weight of the pump and motor assembly.

C. Power and pilot cable supports shall be provided and shall consist of a wire braid sleeve with attachment loops or tails to connect to the under side of the access frame.

D. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembling and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

E. Ensure that the pump intake design meet the acceptable standards of ANSI/HI 9.8 for all pumps.

2.5 PUMPING SYSTEM CONSTRUCTION

A. Pumps:

1. Major pump components, including pump casing, impeller, intermediate housing, and motor housing, shall be of gray cast iron, ASTM A-48, Class 30 or Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities.

2. All exposed nuts or bolts shall be ASTM A-276 Type 316 stainless steel.

3. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

4. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/motor unit mating surfaces shall be machined and fitted with Nitrile or Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact on four sides without the requirement of a specific bolt torque limit. Rectangular cross-sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered adequate or equivalent to specified requirements. Secondary sealing compounds, elliptical O-rings, grease or other devices are unacceptable.

B. Cooling System:

1. Each pump/motor unit shall be provided with an integral, self-supplying cooling system.

2. The motor water jacket shall encircle the stator housing and shall be made of cast iron, ASTM A-48, Class 35B.

3. The water jacket shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.

4. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the cooling system. Two cooling liquid supply pipes, one discharging low and one discharging high within the jacket, shall supply the cooling liquid to the jacket. An air evacuation tube shall be provided to facilitate air removal from within the jacket. Any piping internal to the cooling system shall be shielded from the cooling media flow allowing for unobstructed circular flow within the jacket about the stator housing. Two cooling liquid return ports shall be provided. The internals to the cooling system shall be non-clogging by virtue of their dimensions. Drilled and threaded provisions for external cooling and seal

flushing or air relief are to be provided. The cooling jacket shall be equipped with two flanged, gasketed and bolted inspection ports of not less than four inches in diameter located 180 degrees apart. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40 degrees Celsius (104 degrees Fahrenheit), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures to less than 40 degrees Celsius are unacceptable.

C. Cable and Cable Entry Seal:

1. The power cable shall be suitable for submersible pump and motor applications and sized according to NEC and ICEA standards.

2. The power cable provided shall be of sufficient length to extend from the pumping unit to the terminal junction box without being spliced and shall include enough slack to allow it to be routed and secured out of the way of any equipment in the dry well. It shall be the Contractor's responsibility to ensure that the cable provided by the system supplier is of adequate length to comply with the specified requirements.

3. The outer jacket of the power cable shall be oil resistant chloroprene rubber.

4. The cable seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by Type 316 stainless steel washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems are unacceptable.

D. Motor:

1. The motor shall be suitable for 460-volt, 60 Hertz, 3-phase electric power. Motor horsepower shall be as specified in this Section.

2. The pump motor shall a NEMA B (3 phase) design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180 degrees Celsius (356 degrees Fahrenheit). The stator insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent. The motor shall be inverter duty rated. Inverter duty rated motors shall be in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is unacceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40 degrees Celsius (104 degrees Fahrenheit) with an 80 degrees Celsius temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. The thermal switches shall be used in conjunction and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is unacceptable. The same manufacturer shall produce the motor and the pump.

3. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or

minus 10 percent. A performance chart shall be provided in the submittal showing curves for torque, current, power factor, input/output kW, efficiency, and data on starting and no-load characteristics.

4. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

5. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

E. Pilot Cable:

1. The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (Submersible Cable). The cable shall be shielded, multi-conductor type with a chloroprene outer jacket and the tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 volts and 90 degrees Celsius (194 degrees Fahrenheit) with a 40 degrees Celsius (104 degrees Fahrenheit) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.

F. Bearings:

1. The pump shaft shall rotate on at least 2 grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearing shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.

2. The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

G. Mechanical Seal:

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal.

2. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. In the event of fluid intrusion, fluid shall not come into contact with the lower bearings.

3. The following seal types are not considered acceptable equivalents or alternates to the dual independent seal specified: (a) shaft seals without positively driven rotating members, and (b) conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Systems requiring a pressure differential to offset pressure and to affect sealing shall not be used.

4. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the

pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.

5. Seal lubricant shall be FDA approved and non-toxic.

H. Pump Shaft:

1. Pump and motor shaft shall be a solid, continuous shaft. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of stainless steel and shall be completely isolated from the pumped liquid.

I. Impeller

1. Impellers shall be of gray cast iron, Class 35B, dynamically balanced, multiple vaned, double shrouded non-clogging design having long throughlets without acute turns. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impellers shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum four inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

J. Wear Rings:

1. A wear ring system shall be incorporated into the pump design to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a Nitrile rubber coated steel or brass ring insert that is drive fitted to the volute inlet.

2. This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

K. Volute:

1. Pump volutes shall be single-piece gray cast iron, ASTM Class 30 or Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as shown on the Plans.

L. Protection:

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.

2. A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.

3. A leakage sensor shall be provided to detect water in the stator chamber. The Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and activate an alarm. Use of voltage sensitive solid state sensors shall not be allowed.

4. The thermal switches, FLS and the lower bearing temperature monitor shall be connected to a CAS (Control and Status) monitoring unit. The CAS design shall be such to allow it to be mounted in the control panel.

M. Spare Parts: Provide the following spare parts for each pump unit:

1. One (1) O-ring kit.
2. One (1) Upper Mechanical Seal.
3. One (1) Lower Mechanical Seal.
4. One (1) Upper Bearing.
5. Two (2) Lower Bearings.
6. One (1) Volute Wear Ring.
7. One (1) Impeller Wear Ring.

N. Painting: The pump shall be painted after assembly and testing, with a water reducible air dry enamel. The paint shall be applied in one coat covering all exterior surfaces. The pump shall be air dried after testing and before painting.

2.6 ACCESSORIES

A. Chain Holder: Chain holder shall be Type 316 stainless steel and of the size recommended by the pumping system manufacturer.

B. Anchor Bolts:

C. Anchor bolts shall be Type 316 stainless steel. Pump manufacturer shall provide the size and layout dimensions for all anchor bolts for railings, pump supports, pumps, and accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pumping system installation areas, equipment foundations, and conditions with Installer present to verify compliance with requirements for installation and other conditions affecting installation and performance of pumping systems before beginning pump installation.

B. Examine rough-in for piping systems to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION

A. Install pumping systems and accessories in accordance with manufacturer's written installation and alignment instructions and shop drawings.

B. Support piping such that pumps do not support weight of piping.

3.3 CONNECTIONS

A. Install pressure gages on the discharge pipe of each pump.

B. Install electrical connections for power, controls, and instrumentation devices. Electrical power components, wiring, and connections are specified in Division 26 Sections. Control and instrumentation devices are specified elsewhere in this Section.

C. Ground Equipment:

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING

A. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

3.5 COMMISSIONING

A. Final Checks before Starting: Perform all preventive maintenance operations and checks before start-up in strict conformance with manufacturer’s written instructions.

B. Starting Procedure: Perform start-up for each pumping unit in strict conformance with the manufacturer's written instructions and in the presence of the Owner and Engineer. Provide manufacturer's certification of installation and operation as specified.

C. Factory Service

1. The equipment manufacturer shall provide factory service for installation inspection, equipment start-up, and operator training. Length of service shall be as required to fully train the Owner's personnel in the operation and maintenance of the equipment.
2. At any time within six months of the date of start-up, provide, at Owner's request and at no additional cost, the services of equipment manufacturer's representative(s) on the site for a period not to exceed two days.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing initial testing. Engineer will comment on whether general scope and content of manual are acceptable.

B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing initial testing. Engineer will return copy with comments.

C. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineers comments and prior to commencing initial testing.

D. Furnish, prior to substantial completion, eight copies of final maintenance manuals. All corrections shall have been made necessary to comply with Engineer's comments in the final manuals. Final manuals shall be indexed and composed of suppliers' maintenance manuals on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished.

E. Maintenance manuals are to be of a hardback, loose-leaf type and of a durable quality. In addition, a complete electronic copy shall be provided in MS-Word or searchable Adobe PDF format.

F. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted. Where non-relevant information is present in the manual, it shall be neatly marked out with a single "X" through non-relevant portions.

G. Include in each set of manuals the following:

1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
2. Control and wiring diagrams.
3. Installation, operation (including start up and shut down procedures), lubrication and maintenance instructions.
4. Manufacturers recommended spare parts list.

H. If an Owner's representative is assigned to the project either through the Owner or the Engineer, the Contractor shall make a copy of all instruction manuals available to the Representative. Manuals on specific items shall be available prior to installation of the item. This requirement in no way relieves the Contractor of his other responsibilities.

END OF SECTION