CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS

FOR

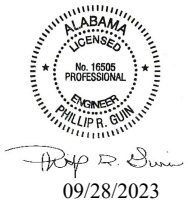
SULLIVAN WTP
REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB

October 2023

Prepared For:

THE GORDO WATER GAS AND SEWER BOARD
313 Main Street
Gordo, Alabama 35466

Prepared by:



09/28/2023

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engineers
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surveyors
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structural designers

ADDENDUM NO. 1
SULLIVAN WATER TREATMENT PLANT REHABILITATION PROECT – PHASE 2
EQUIPMENT BUILDING & CLEARWELL REHAB
DWSRF PROJECT FS010412-01
NEEL SCHAFFER PROJECT NS.17174.000

October 9, 2023

Replace the following drawing sheets with the attached: Drawing E-04, sheet 21 of 38 with drawing E-04R, sheet 21 of 38; Drawing E07, sheet 24 of 38 with drawing E-07R, sheet 24 of 38; Drawing E-08, sheet 25 of 38 with drawing E-08R, sheet 25 of 38 and Drawing E-18, sheet 34 of 38 with drawing E-18R, sheet 34 of 38. These revised drawings shall be added to the contract documents and shall carry the same weight as though they were included in the original contract documents:

ALABAMA LICENSED No. 16505 PROFESSIONAL ENGINEER PHILLIP R. GUIN

10/09/23

Phillip R. Guin, P.E.

Two Perimeter Park South Suite 230 E Birmingham, AL 35243 Office 205-397-3800 Fax 205-397-3900

SULLIVAN WATER TREATMENT PLANT REHABILITATION –
PHASE 2 SULLIVAN WTP REHABILITATION – PHASE 2
GORDO WATER, GAS, AND SEWER BOARD

Contract Documents and Technical Specifications

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DIVISIONS 4 through 10 – NOT USED

DIVISION 11 - EQUIPMENT

DIVISIONS 12 through 14 – NOT USED

DIVISION 15 - MECHANICAL

DIVISION 16 - ELECTRICAL

SECTION 00100
ADVERTISEMENT FOR BIDS

SULLIVAN WATER TREATMENT PLANT REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB
DWSRF #FS010412-01

Sealed bids will be received by the Gordo Water, Gas and Sewer Board **10:00 A.M. Local Time, October 26, 2023,** at THE GORDO WATER, GAS AND SEWER BOARD, 313 Main Street, Gordo, AL 35466 for supplying all labor and materials (as specified) necessary for **SULLIVAN WATER TREATMENT PLANT REHABILITATION PROJECT, PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB DWSRF #FS010412-01.**

Contract time shall be **300** consecutive calendar days from the effective date shown in the Notice to Proceed. Liquidated damages will be assessed for each consecutive calendar day thereafter in the amount as specified herein.

Principle items of work include but are not limited to: removal and replacement of existing vertical turbine high service pumps; removal and replacement of existing valves; removal and replacement of existing aerator tower assembly; refurbishment of existing equipment building and replacement of existing chemical and chlorination equipment; installation of diesel engine driven emergency power generator; and rehabilitation of existing clear well. Additionally, the project also includes installation of an emergency standby power generator at the Downtown WTP location.

Bidders must be qualified under Alabama Law to perform the construction activities desired by the Owner and must be registered with the State of Alabama's Licensing Board for General Contractors as appropriate. Furthermore, the successful Bidder, whether a resident or nonresident of the State of Alabama, shall be required to comply with all other applicable City, County and State licensing and/or permit laws.

Proposals shall be submitted, sealed and deposited with the Gordo Water, Gas and Sewer Board at the Gordo Water, Gas and Sewer Board offices, prior to the hour and date hereinbefore designated. No bidder may withdraw his bid within ninety (90) days after the actual date of the opening thereof.

Each Bidder must deposit with his proposal a Bid Bond or Certified Check in an amount equal to five percent (5%) of his bid, payable to the Gordo Water, Gas and Sewer Board, as bid security. Bidders shall also submit a current financial statement, if requested by the Owner. The successful bidder will be required to furnish a Payment Bond and Performance Bond each in the amount of one hundred percent (100%) of the contract amount.

A mandatory Pre-Bid Conference will be held at 9:00 A.M., Local Time October 19, 2023, at the Gordo Water, Gas and Sewer Board offices, 313 Main Street, Gordo, AL 35466. Prospective Contractors must have a representative in attendance at this meeting for their bid to be considered.

Contract Drawings, Contract Specifications, Bidders Information and Bid Forms are on file and available for review at the following locations:

1. *Gordo Water, Gas and Sewer Board, 313 Main Street, Gordo, Alabama 35466*
2. *Alabama Graphics Digital Plan Room website a*t https://www.algraphicsplanroom.com

Contract Drawings, Contract Specifications, Bidders Information and Bid Forms are available for purchase at the following location:

1. *Alabama Graphics, Inc. 2801 5th Avenue South, Birmingham, Alabama 35233, Main 205-252-8505, Web Site:* https://www.algraphicsplanroom.com

All questions regarding this project should be forwarded to Neel-Schaffer, Inc., Attention: Phillip R. Guin, P.E., email phillip.guin@neel-schaffer.com, or phone at: 205-799-3421. All questions should be received 48 hours prior to bid opening to allow time for addenda, if necessary.

The Gordo Water, Gas and Sewer Board reserves the right to reject any and all bids and to waive any informalities or irregularities therein.

BY: Honorable Craig Patterson, Mayor
Town of Gordo, Alabama

SECTION 00300

INSTRUCTIONS TO BIDDERS

CONTENTS

INSTRUCTIONS TO BIDDERS

1. COORDINATION OF SPECIFICATIONS

Work under this Contract shall be performed in accordance with the Contract Documents, which includes General Conditions, Supplementary Conditions, Technical Specifications and Contract Drawings contained therein.

2. DATE AND PLACE OF OPENING OF PROPOSALS

Bids will be opened commencing at 10:00 a.m. Local Time, October 26, 2023, at the Gordo Water, Gas and Sewer Board offices, 313 Main Street, Gordo, Alabama 35466.

The Gordo Water, Gas and Sewer Board, herein called "Owner", reserves the right to postpone the date for presentation and opening of Proposals and will give notice of any such postponement to each known prospective Bidder.

3. FORM FOR PROPOSALS

Proposals must be submitted on the forms furnished by the Owner and the envelope containing the Proposals must be sealed and addressed to:

Craig Patterson, Mayor
Gordo Water, Gas and Sewer Board
313 Main Street
Gordo, Alabama 35466

The outside of the envelope containing the Proposal shall bear the inscription:

Sealed Bid for: GORDO WATER, GAS AND SEWER BOARD
SULLIVAN WATER TREATMENT REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB

BY

General Contractor's License No.

If Proposals are forwarded by the U.S. Postal Service, delivery shall be by Registered or Certified Mail.

4. PRE-BID CONFERENCE

A mandatory pre-bid conference will be held at 9:00 a.m., local time on October 19, 2023 at the Gordo Water, Gas and Sewer Board offices, 313 Main Street, Gordo, AL 35466. Prospective bidders are required to have a representative in attendance for their bid to be considered for this project.

5. GENERAL CONTRACTOR'S LICENSE

The Alabama State Law governing general contractors as set forth in the Code of Alabama requires all bidders to possess a valid general contractor's license, including specialty classifications for the work, and that each bid may not be considered without evidence being produced that he/she is qualified. Non-resident contractors must be registered under State law to do business in Alabama. Each bidder MUST include with his/her proposal the current general contractor's license number and a copy of the license.

6. IN STATE BIDDER PREFERENCE

As required by the Code of Alabama (1975) 39-3-5, in the letting of public contracts in which municipal funds are utilized, except those contracts funded in whole or in part with funds received from a federal agency, preference shall be given to resident contractors, and a nonresident bidder domiciled in a state having laws granting preference to local contractors shall be awarded Alabama public contracts only on the same basis as the nonresident bidders' state awards contracts to Alabama contractors bidding under similar circumstances.

Nonresident bidders must accompany any written bid documents with a written opinion of an attorney licensed in such nonresidents bidder's state of domicile, as to the preferences, if any or none, granted by the law of that state to its own business entities whose principal places of business are in that state in the letting of a public contract.

7. CHARGES FOR PROPOSALS, PLANS AND SPECIFICATIONS

Prospective Bidders may obtain Proposal forms, including one (1) copy of Contract Documents upon payment of the amount of money stipulated in the "Advertisement for Bids."

Extra copies of the Plans and Specifications, excluding the Standard Specifications, may be procured from the office of Neel-Schaffer, Inc., Two Perimeter Park South, Suite 230E, Birmingham, Alabama 35243 according to the following schedule:

Complete Set of Plans and Specifications..... $250.00

No refunds will be made for return of Plans or Specifications

If a contract award is made, the successful Bidder will be furnished (free of charge) two (2) additional sets of the Plans and Specifications.

In the event all Bids are rejected, and the Project is re-advertised, the original Bidders shall be entitled to free Proposals for the subsequent letting.

8. OMISSIONS AND DISCREPANCIES

Should a Bidder find discrepancies, errors or omissions in the Specifications, or should he be in doubt as to the correctness of the details, dimensions and layout, he should immediately notify the Owner in order to permit checking and any necessary revisions or modifications.

9. ADDENDA

Prior to the date set for opening of Bids, the right is reserved, as the interest of the Owner may require, to revise or amend, the Contract Documents. Such revisions, if any, will be announced by an Addendum or Addenda, and numbered copies of such Addenda will be furnished to all prospective

Bidders who have purchased Plans and Specifications for acknowledgement by return mail. If the revisions and Addenda are of a nature which require material changes in quantities or prices Bid, or both, the date set for opening Bids may be postponed to enable Bidders to revise their Bids. In such case, the Addendum or Addenda will include an announcement of the new date for opening Bids.

10. INTERPRETATIONS

No oral interpretation made to any Bidder as to the meaning of the Contract Documents shall be considered an effective modification of any of the provisions of the Contract Documents. Written requests for interpretation of the Specifications shall be submitted to the Owner at least 10 days prior to opening of Proposals so that a formal decision can be given in writing to all known prospective Bidders in the form of an Addendum.

The Contract Document contains the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the Owner or any other person shall not affect the risks or obligations assumed by the Contractor or relieve him from fulfilling any of the conditions of the Contract.

11. BID SECURITY

All Bids shall be accompanied by a Bid Security in the form of a Certified Check upon a national or state bank or a Bid Bond made by a bonding company registered in the State of Alabama, drawn and made payable to the order of the Owner, in an amount equal to five percent (5%) of the Bid. The Certified Check or Bid Bond must be enclosed in the same envelope with the Bid. Except as noted below, the Bid Security of all known unsuccessful Bidders will be returned promptly after a Notice of Award has been sent to the successful Bidder or in the event that all Bids are rejected. Bid Security in the form of a Bid Bond will not be returned.

The Bid Security of the successful Bidder will be returned when satisfactory Performance and Payment Bonds have been furnished and approved and the Contract executed. The Bid Security of the next two lowest qualified Bidders will be retained until the Contract has been executed with the lowest qualified Bidder. If the lowest qualified Bidder fails to execute the Contract, this Bid Security shall be forfeited to the Owner as liquidated damages and the Contract may be awarded to the next lowest Bidder at the Owner's discretion.

12. GENERAL INFORMATION

Bidders shall inform themselves and comply with all State and Federal laws, licenses and tax liabilities which may in any manner affect their Bids and the prosecution of the work.

Special attention is directed to the rules and regulations published by the Alabama State Tax Commission outlining certain taxes imposed on Contractors by the State of Alabama.

13. REJECTION OF PROPOSAL

Proposals may be rejected in the case of any omission, alterations of forms, additions or conditions not called for, unauthorized alternate Bids, incomplete Bids, erasures, or irregularities of any kind. Bids received conditioning their consideration or rejection upon Bids for the other work submitted by the same Bidder may be classed as irregular, unless the Contract Documents specifically invite or permit conditional or combination Bids. Bids in which the prices obviously are unbalanced may be rejected.

14. CONDITIONS OF WORK

Each Bidder must inform himself fully of the conditions relating to the construction of the Project and the employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligation to furnish all materials and labor necessary to carry out the provisions of his Contract. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

15. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the Executed Contract, the Contractor shall furnish a Performance Bond and a Payment Bond each in the sum of 100% of the Contract amount as security for faithful performance of his Contract and for the payment of all persons performing labor on the Project under his Contract and furnishing materials in connection with his Contract, as specified in the Contract Documents. The surety of such Bonds shall be issued by a duly authorized surety company listed on the Treasury Department's most current list Circular 570 (as amended) and satisfactory to the Owner.

Attorneys in fact who sign Bid Bonds or Payment Bonds and Performance Bonds must file with each bond a certified and effective dated copy of their Power of Attorney. Failure of the successful Bidder to execute the Contract and to supply the required bonds within ten (10) calendar days from the date that the Notice of Award is delivered, or within such extended period as the Owner may grant based upon reasons determined sufficient by the Owner, shall constitute a default, and the Owner may either award the Contract to the next lowest qualified Bidder or re-advertise for Bids, and may charge against the Bidder the difference between the amount for which a Contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the Bid Bond. If a more favorable bid is received by re-advertising, the defaulting Bidder shall have no claim against the Owner for a refund.

The Contractor's bond will not be released until all provisions of the Contract have been fulfilled.

16. INSURANCE

The Contractor will be required to carry the types and amounts of insurance named in the General Conditions of the Contract Documents for the full life of the Contract. In addition, the Contractor shall provide a letter from the Insurance Agent verifying insurance coverage meets or exceeds the required insurance coverage and amounts specified.

17. SUBCONTRACTORS

Bidders are specifically advised that any person, firm or other party to whom it is proposed to award a Subcontract must be acceptable to the Owner. Nothing contained in the Contract Documents shall create any contractual relation between subcontractor and the Owner.

18. METHOD OF AWARD - LOWEST AND BEST RESPONSIVE BIDDER

The Owner will award the Contract to the lowest responsive, responsible Bidder with the lowest Base Bid or lowest combination of the Base Bid and those alternates selected by the Owner in any order determined to be in the best interest of the Owner and which produces a total within available funds unless all Bids are rejected.

The responsiveness of the lowest and best Bidder shall be determined by (1) the completeness and

regularity of the Bid Form; (2) the Bid Form being without exclusions or special conditions; (3) the Bid Form having no alternative Bids for any item unless requested in the Technical Specifications; and (4) such other factors as may be considered under State law, Federal law or regulation.

The evaluation of the lowest and best bidder will be based on whether the Bidder (1) maintains a permanent place of business; (2) has adequate plant equipment to do the work properly and within the time limit that is established; (3) has adequate financial status to meet his obligations contingent to the work; (4) has adequate manpower and present workload is such that he can perform according to a reasonable schedule; and (5) such other factors as may be considered under State law, Federal law or regulation.

19. OBLIGATION OF BIDDER

At the time of the opening of Bids, each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Plans and Contract Documents (including all Addenda).

The failure or omission of any Bidder to examine any form, instrument or document shall in no way relieve any Bidder from any obligation in respect to his Bid. Submission of Bid shall be accepted as prima facie evidence that Bidder has inspected the site and is familiar with the Plans and Contract Documents.

20. USE OF DOMESTIC STEEL

As required by the Code of Alabama (1975) 39-3-4, contractors are required to use steel produced in the United States for municipal construction projects when specifications in the construction contract require the use of steel and do not limit its supply to a sole source. This provision is subject to waiver if the procurement of domestic steel products becomes impractical as a result of national emergency. Violations of the use of domestic steel requirements shall result in a downward adjustment in the contract price equal to any savings or benefit to the Contractor.

21. EXECUTION OF CONTRACT

If the successful Bidder is a corporation, the officer who signs the Contract shall furnish copies of the resolution of the Directors of the corporation authorizing him to sign the contract. Such resolution must bear the seal of the corporation.

Subject to the applicable provisions of law, the Contract shall be in full force and effect only from and after the date when a fully executed and approved counterpart thereof has been rendered or delivered, or both, to the Contractor or his duly authorized agent or representative. Deposit of said counterpart in the United States mail in an envelope or wrapper properly addressed shall constitute compliance with these provisions by the Owner.

22. INTERCHANGEABLE TERMS

The terms "Bid" and "Proposal" wherever they are used in the Contract Documents are interchangeable and have the same meaning. The terms "Gordo Water, Gas and Sewer Board" and "Owner," are interchangeable and have the same meaning. The terms "Contract" and "Agreement," are interchangeable and have the same meaning.

23. QUALIFICATIONS OF BIDDER, OWNER'S RIGHTS

The Owner may make such investigation as it deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by or investigation of such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

24. MATERIALS AND EQUIPMENT

Whenever using the name of a manufacturer, fabricator, supplier, or distributor, the naming of the item in this manner is intended to establish the type, function and quality required. Materials or equipment of other manufacturers, fabricators, suppliers, or distributors may be accepted by the Owner if sufficient information is submitted by the Contractor to allow the Owner to determine that the material or equipment proposed is comparable to that named in the Contract Documents.

25. U.S. PRODUCTS PREFERENCE

The successful contractor shall comply with the Code of Alabama 91975) 39-3-1 and shall agree to utilize during the execution of the projects, materials, supplies and products manufactured, mined, processed or otherwise produced in the United States or its territories, if the same are available at reasonable and competitive prices and not contrary to any sole source specifications. It is further stipulated that a breach of the foregoing provisions of this agreement by the contractor in failing to utilize domestic products shall result in a downward adjustment in the contract price equal to any realized savings or benefit to the Contractor.

26. E-VERIFY REQUIREMENTS

Pursuant to the requirements of the Beason-Hammon Alabama Taxpayer and Citizen Protection Act ("the Act"), as a condition for the award of any contract, grant, or incentive by the state, any political subdivision thereof, or any state-funded entity to a business entity or employer that employs one or more employees, the business entity or employer shall provide documentation establishing that the business entity or employer is enrolled in the E-Verify program. During the performance of the contract, the business entity or employer shall participate in the E-Verify program and shall verify every employee that is required to be verified according to the applicable federal rules and regulations. The Act also provides that no subcontractor on a project paid for by contract, grant, or incentive by the state, any political subdivision thereof, or any state-funded entity shall knowingly employ, hire for employment, or continue to employ an unauthorized alien and shall attest to such by sworn affidavit signed before a notary. The subcontractor shall also enroll in the E-Verify program prior to performing any work on the project and shall attach to the sworn affidavit documentation establishing that the subcontractor is enrolled in the E-Verify program.

END OF SECTION

SECTION 00400

BIDDER'S PROPOSAL

CONTENTS

SECTION 00400

BIDDER'S PROPOSAL

DATE: _____, 2023

PROPOSAL OF _____
(Name of Bidder)

_____
(Address of Bidder)

for the **SULLIVAN WATER TREATMENT PLANT REHABILITATOIN PROJECT, PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB, DWSRF #FS010412-01**

The Documents on which this Proposal is based are the Instructions to Bidders Bid Forms, General Provisions, Supplementary General Provisions, Special Provisions, and all supplements, amendments, and addenda for this Project, made a part hereof by reference.

TO: HONORABLE CRAIG PATTERSON, MAYOR
GORDO WATER, GAS, AND SEWER BOARD
313 MAIN STREET
GORDO, ALABAMA 35466

Gentlemen:

The following Proposal is submitted on behalf of the undersigned Bidder(s) and no others. Evidence of my (our) authority to submit the Proposal is hereby furnished. The Proposal is submitted without collusion on the part of any person, firm or corporation.

I (We), the undersigned Bidder(s), certify that I (we) have carefully examined the Instructions to Bidders, Bid Forms, Standard Specifications, General Provisions, Supplemental General Provisions, Special Provisions, Contract Drawings and other proposed Contract Documents and any and all Addenda thereof.

I (We) further certify that I (we) have visited and carefully examined the site of the proposed Work and have inspected the location and condition of all public utilities and existing structures or other facilities on the site or adjacent thereto which may be affected by the proposed construction and fully understand all conditions relative to construction difficulties, hazards, labor, transportation and all other factors affecting the prosecution of the work covered by this Proposal.

In accordance with the requirements of the Instructions to Bidders, Bid Forms, Standard Specifications, General Provisions, Supplemental General Provisions, Special Provisions, Contract Drawings, and other proposed Contract Documents and any and all addenda thereof, I (we) propose to furnish all necessary materials, equipment, labor, tools and other means of construction and will do all Work called for by the Contract Documents within the specified Contract Time for the following unit prices.

The following is my (our) itemized proposal for the Gordo Water, Gas and Sewer Board, **Sullivan Water Treatment Plant Rehabilitation Project, Phase 2 – Equipment Building & Clearwell Rehab, DWSRF #FS010412-01.**

All erasures, changes or alterations of any kind must be initialed by the bidder.

In case of discrepancy between a unit price and the extension, the unit price will govern and the extension along with the total amount of the proposal will be corrected.

Unit prices shall include all labor, materials, equipment, supervision, overhead, profit, insurance, etc. to cover the finished work of the several kinds called for.

Having carefully examined the plans and specification for the **Sullivan Water Treatment Plant Rehabilitation Project, Phase 2 – Equipment Building & Clearwell Rehab**, we propose to complete the work specified in the project Contract Documents in accordance with the following lump sum bid prices and unit bid prices for the TOTAL BASE BID PRICE shown in the following Summary of Quantities and Bid Proposal Table.

Bid Proposal Table
for
SULLIVAN WATER TREATMENT PLANT REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB (DWSRF #FS010412-01)

Bid Item #	Bid Item Description	Units	Estimated Quantity	Unit Price	Total Price
1.0	Mobilization, Demobilization, Bonds, Insurance, Permits, etc. (not to exceed 7% of the Total Bid Price)	LS	1		
2.0	Building & Equipment Demolition, including building interior/exterior demolitions as well as removal of aerator equipment, high service pumps, pipe and fittings, miscellaneous outdoor components, etc.	LS	1		
3.0	Rehabilitate Existing Clear Well, including installation of underdrain piping	LS	1		
4.0	Furnish and Install New High Service Vertical Turbine Pumps, Pump Discharge Piping, Valves, Flow Meter, and New 4" Discharge Pipe	LS	1		
5.0	Improvements and Refurbishment of Existing Building, including new roof structure, new electrical equipment, new windows, all interior renovations, new water piping, etc.	LS	1		
6.0	Furnish and Install New Chemical Feed and Chlorination Equipment	LS	1		
7.0	Furnish and Install New Concrete Slab, Generator and Fuel Tank	LS	1		
8.0	Furnish and Install New Aerator and Blower Equipment	LS	1		
	TOTAL BASE BID PRICE (Sum of Items 1.0 to 8.0)				

TOTAL BASE BID PRICE: _____
(written in words)

_____ Dollars.

Bidder understands that the Owner reserves the right to reject any of all bids and to waive any formalities in the bidding. Bidder agrees that this bid shall be good and may not be withdrawn for a period of 90 calendar days after the schedule closing time for receiving bids.

THE BIDDER'S TOTAL ABOVE IS HIS TOTAL BID BASED ON HIS UNIT PRICES AND LUMP SUM PRICES AND THE ESTIMATED QUANTITIES. THIS FIGURE IS FOR INFORMATION

ONLY AT THE TIME OF OPENING BIDS. THE OWNER WILL MAKE THE BID TABULATION FROM THE UNIT PRICES AND LUMP SUM PRICES BID. IF THERE IS AN ERROR IN THE TOTAL BY THE BIDDER, IT SHALL BE CHANGED AS ONLY THE UNIT PRICES AND LUMP SUM PRICES SHALL GOVERN.

I (We) further propose to execute the Contract Agreement as bound herein within ten working days after receipt of the contract forms from the Owner. I (We) agree to complete the work in the Contract Documents within 300 consecutive calendar days after the notice to proceed. I (We) agree to pay as liquidated damages the sum of $300.00 for each consecutive calendar day thereafter as provided in the Contract Documents.

I (We) also propose to execute a Performance Bond and a Payment Bond, as shown in the Specifications, each in an amount of not less than one hundred percent (100%) of the total of my (our) Bid. These Bonds shall not only serve to guarantee the completion of the Work on my (our) part, but also to guarantee the excellence of both workmanship and materials until the Work is finally accepted.

I (We) enclose a Bid Bond or Certified Check for 5 percent of the base bid amount and hereby agree that in case of my (our) failure to execute the Contract and furnish the Bonds within ten calendar days after delivery of the Notice of Award, the amount of this check (Bid Bond) will be forfeited to the Gordo Water, Gas and Sewer Board as damages arising out of my (our) failure to execute the Contract as proposed.

It is understood that in case I (we) am/are not awarded the Work, the Certified Check or Bid Bond submitted as Bid security will be returned as stipulated in the Contract Documents.

Bidder acknowledges receipt of the following Addenda:

No. ___ Dated _____ No. ___ Dated _____

No. ___ Dated _____ No. ___ Dated _____

No. ___ Dated _____ No. ___ Dated _____

No. ___ Dated _____ No. ___ Dated _____

Respectfully Submitted,

_____

Contractor(s)

By: _____

(Authorized Signature)

Title: _____

Address: _____

_____

BIDDER'S CORPORATE DECLARATION
(To Be Completed If Bidder is a Corporation)

Date: _____, 20____

Our corporation is chartered under the Laws of the State of _____

and the names, titles and business addresses of the executives are as follows:

_____	_____
President	Secretary
_____	_____
_____	_____
_____	_____
_____	
Treasurer	
_____	
_____	
_____	

DECLARATION OF PARTNERSHIP
(To be filled in if a Bidder is a Partnership)

Our Partnership is composed of the following individuals:

_____	_____
_____	_____
Address	Address
_____	_____
Address	Address

NON-COLLUSION AFFIDAVIT

(This affidavit must be executed for the Bid to be considered)

STATE OF ALABAMA

COUNTY OF _____)

_____
(Person)

being first duly sworn, deposes and says that he is _____
(Sole owner, a partner, president, secretary, etc.)

of _____
(Name of Firm)

the party making the foregoing Proposal or Bid; that such Bid is genuine and not collusive; that said Bidder is not financially interested in, or otherwise affiliated in a business way with any other bidder on the same contract; that said Bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidder or person, to put in a sham bid, or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against the **Gordo Water, Gas and Sewer Board**, or any person or persons interested in the proposed contract; and that all statements contained in said Proposal or Bid are true; and further, that such Bidder has not, directly or indirectly submitted his Bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

_____
Affiant

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

_____
Notary Public in and for

_____ County, Alabama

(SEAL) My Commission Expires_____, 20____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

_____ as Principal,

and _____

as Surety, are hereby held and firmly bound unto the **GORDO WATER, GAS AND SEWER BOARD** as Owner, in the penal sum of _____

for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns. Signed this ___ day of_____, 20____.

The condition of the above obligation is such that whereas the Principal has submitted to the **GORDO WATER, GAS AND SEWER BOARD,** a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing for the **SULLIVAN WATER TREATMETN PLANT REHABILITATION PROJECT, PHASE 2 – EQUIPMENT BUILDING & CLEARWELL REHAB, DWSRF #FS010412-01.**

NOW THEREFORE,

(a) If said Bid shall be rejected, or in the alternate,

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____

Contractor

SEAL By: _____

_____

Surety

SEAL By: _____

PROPOSED SUBCONTRACTORS

The names and addresses of all persons and parties who will be utilized for subcontract Work in the foregoing Base Bid are listed below. (The Contractor must list all Subcontractors to be utilized on the Work. Failure to list Subcontractors may cause the Bidder's Bid to be rejected by the Owner as non-responsive.)

NAME	ADDRESS

SECTION 00500

CONTRACT FORMS

CONTENTS

CONTRACT

This Contract made this, the _____ day of _____, 20__, by and between the Gordo Water, Gas and Sewer Board, hereinafter called "Owner" and _____ _____ doing business as a _____ located in _____ (Corporation, Partnership, or Individual) _____hereinafter called the "Contractor".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR will commence and complete the **"Sullivan Water Treatment Plant Rehabilitation Project, Phase 2 – Equipment Building & Clearwell Rehab"** in strict accordance with the Contract Documents and the Contract Drawings.

2. The Contractor will commence the work required by the Contract Documents within 10 calendar days after the date of the Notice to Proceed and will attain Final Completion within **300** consecutive calendar days unless the period for completion is extended otherwise by the Contract Documents. The Contractor agrees to pay, as liquidated damages an amount as specified herein for each consecutive calendar day that he shall be in default in attaining Final Completion within the time stipulated as provided herein.

3. The term "Contract Documents" means and includes Advertisement for Bids, Instructions to Bidders, Bidder's Proposal, Bid Bond, Contract, Payment Bond, Performance Bond, General Conditions, Supplementary Conditions, Technical Specifications, Contract Drawings, Notice of Award, Notice to Proceed, Addenda (if any), and all subsequent Change Orders, Supplemental Agreements and/or other modifications as if formally recopied in this Contract.

4. The Contractor agrees to furnish all materials in place and to faithfully complete all of said work contemplated by this Contract in good and workmanlike manner, strictly in accordance with said Contract Documents, Contract Drawings and other requirements of the Owner, and to the complete satisfaction of the Owner, or his authorized representatives, and in accordance with the Laws of the State of Alabama and the Ordinances of the Town of Gordo, for which the Owner hereby agrees to pay and the Contractor agrees to accept a sum of money in current funds equal to the contract amount of _____ _____ and 00/100---Dollars ($) plus the amount of any supplemental agreements and force accounts for extra work authorized and duly set forth in a written change order approved and executed by the Owner and set forth in the public minutes of the Owner and in full compensation for furnishing all materials, the doing of all work contemplated under the Contract, as well as all loss or damage, if any, arising out of the nature of the work, or the action of the weather, and any and all other unforeseen obstructions or difficulties that may be encountered in the prosecution of the same, the Contractor assuming all risks of every kind and description in the performance of this Contract.

5. The Contractor shall protect, indemnify and save harmless the Owner from and against any and all damage, loss, claims, judgments or expenses, including but not limited to reasonable attorney's fees, which the Owner may suffer or be subjected to by the performance of the work, including but without limitation, injury to or death of any person whomever and destruction or damage to any property whatsoever.

6. Attached hereto and made a part of this Contract is a Performance Bond, executed by a Surety Company doing business in the State of Alabama, in the sum of _____ and 00/100---------- Dollars ($_____).

7. Attached hereto and made a part of this Contract is a Payment Bond, executed by a Surety Company doing business in the State of Alabama, in the sum of _____ and 00/100---------- Dollars ($_____).

8. The Contractor agrees to allow the Owner, or any of their duly authorized representatives, access to any books, documents, papers and records of the Contractor which are directly pertinent to the project which is the subject of this Contract, for the purpose of making audits, examinations, excerpts and transcriptions, and Contractor agrees to insert an identical clause in any and all subcontracts.

9. The Owner will pay to the Contractor in the manner and at such times and amounts as set forth in the Contract Documents.

10. This Contract shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

11. If, through any cause, the Contractor shall fail to fulfill in a timely and proper manner his obligations under this Contract, or if the Contractor shall violate any of the covenants, agreements, or stipulations of this Contract, the Owner shall thereupon have the right to terminate this Contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least five days before the effective date of such termination. Notwithstanding the above, the Contractor shall not be relieved of liability to the Owner for damages sustained by the Owner by virtue of any breach of the Contract by the Contractor and the Owner may withhold any payments to the Contractor until such time as the exact amount of damages due the Owner from the Contractor is determined.

IN WITNESS THEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Contract in five counterparts, each of which shall be deemed an original on the date first above written.

Gordo Water, Gas and Sewer Board	
Owner	Contractor
BY _____	BY _____
ATTEST _____	ATTEST _____
(Seal)	(Seal)

PARTNERSHIP CERTIFICATE

State of _____

County of _____ .

On this _____day of _____, 20___, before me personally appeared _____, known to me and known by me to be the person who executed the above instrument, who being by me first duly sworn, did depose and say that he is a general partner in the firm of _____; _____; that said firm consists of himself and _____ _____; and that he executed the foregoing instrument on behalf of said firm for the uses and purposes stated herein.

_____

Notarial Seal

Notary Public in the
County of _____
State of _____
My Commission Expires:

_____

CORPORATE CERTIFICATE

I, _____certify that I am the Secretary of the Corporation named as Contractor in the foregoing Contract; that _____, who signed said Contract on behalf of the Contractor was then _____of said Corporation; that said Contract was duly signed for and in behalf of said Corporation by authority of its governing body and is within the scope of its corporate powers.

_____
Secretary

Corporate Seal

GENERAL INSTRUCTIONS FOR BONDS

1. The surety on each Bond must be a responsible surety company, which is qualified to do business in Alabama and satisfactory to the Owner.

2. The name, including full legal name and residence of each individual party to the Bond shall be inserted in the body thereof, and each such party shall sign the Bond with his usual signature on the line opposite the seal and if signed in Maine, Massachusetts or New Hampshire an adhesive seal shall be affixed opposite the signature. The Bond must be either signed or countersigned by an Alabama Resident Agent of the Surety Company.

3. If the principals are partners, their individual names will appear in the body of the Bond with the recital that they are partners composing a firm, naming it; and all the members of the firm shall execute the Bond as individuals.

4. The signature of a witness shall appear in the appropriate place, attesting to the signature of each individual party to the Bond.

5. If the principal or surety is a corporation, the name of the state in which incorporated shall be inserted in the appropriate place in the body of the Bond, and said instrument shall be executed and attested under the corporate seal as indicated in the form. If the corporation has no corporate seal the fact shall be stated, in which case, a scroll or adhesive seal shall appear following the corporate name.

6. The official character and authority of the person or persons executing the Bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form attached hereto. In lieu of such certificate there may be attached to the Bond copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The date of this Bond must not be prior to the date of the Contract in connection with which it is given.

8. 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 where the project is located.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that

_____

(Name of Contractor)

_____

(Address of Contractor)

a_____hereinafter called Principal, and
(Corporation, Partnership, or Individual)

_____

(Name of Surety)

_____

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

_____

(Name of Owner)

_____

(Address of Owner)

hereinafter called Owner, in the penal sum of _____ and 00/100----------Dollars, ($_____), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated _____ day of _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

_____

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

NOW, THEREFORE, if the Principal shall promptly make payment of all taxes, licenses, assignments, contributions, damages, penalties, and interest thereon, when and as the same may lawfully be due the State of Alabama, or any county, municipality, board, department, commission, or political subdivision thereof, by reason of and directly connected with the performance of said Contract or any part thereof as provided by Sections 27-65-1, 27-65-21, 27-67-301 and 31-5-3, supra, or any other applicable statute or other authority, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

PROVIDED FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the Specifications.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this statement is executed in _____ (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20___.

ATTEST:

_____
(Principal) Secretary

(SEAL)

_____
Witness as to Principal

_____
Address

_____

_____
Principal

By: _____

_____
Address

_____

ATTEST:

_____
Witness as to Surety

_____
Address

_____

_____
Surety

By: _____
Attorney-in-Fact

_____
Address

_____

NOTE: Date of Bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute Bond.

IMPORTANT: 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 where the Project is located.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that

_____
(Name of Contractor)

_____
(Address of Contractor)

a _____ _____ _____hereinafter called Principal, and
(Corporation, Partnership, or Individual)

_____
(Name of Surety)

_____
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

_____
(Name of Owner)

_____
(Address of Owner)

hereinafter called Owner, in the penal sum of _____ and 00/100----------Dollars, ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated _____ day of _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

_____

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, Subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the Work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such Work, and all insurance premiums on said Work, and for all labor, performed in such Work whether by Subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the Specifications.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ (number) counterparts, each one of which shall be deemed an original, this the _____day of _____, 20___.

ATTEST:

_____
(Principal) Secretary

(SEAL)

_____
Witness as to Principal

_____
Address

_____

_____
Principal

By: _____

_____
Address

_____

ATTEST:

_____
Witness as to Surety

_____
Address

_____

_____
Surety

By: _____
Attorney-in-Fact

_____
Address

_____

NOTE: Date of Bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute Bond.

IMPORTANT: 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 where the Project is located.

NOTICE OF AWARD

Date

To: Company
Address
City, State, Zip

Attn: Name

RE: GORDO WATER, GAS AND SEWER BOARD
SULLIVAN WATER TREATMENT PLANT REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILIDNG & CLEARWELL REHAB

Gentlemen:

The GORDO WATER, GAS AND SEWER BOARD has considered the Proposal submitted by you for the above-referenced Work in response to its Advertisement for Bids and Instructions to Bidders.

You are hereby notified that your Proposal has been accepted in the amount of $_____

_____ and 00/100 dollars ($_____).

You are required by the Instructions to Bidders to execute the Contract and furnish to the **GORDO WATER, GAS AND SEWER BOARD** the required Contractor's Performance Bond, Payment Bond and certificates of insurance within 10 calendar days from the date of delivery of this Notice to you. We have enclosed five copies of the necessary contract forms and bond forms. Please return all five copies of these documents to the **GORDO WATER, GAS AND SEWER BOARD**

If you fail to execute said Contract and to furnish said Bonds within 10 days from the date of delivery of this Notice, the Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your proposal as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by Law.

You are required by the General Conditions and Supplementary Conditions to submit to **GORDO WATER, GAS AND SEWER BOARD** an estimated progress schedule, a preliminary schedule of Shop Drawing submissions and a preliminary schedule of values of the Work within 10 days after the effective date of this Contract, all in accordance with Article 2.5 of the General Conditions.

You are required to return an acknowledged copy of this Notice of Award directly to the **GORDO WATER, GAS AND SEWER BOARD**

Sincerely,

GORDO WATER, GAS AND SEWER BOARD

_____
Phillip R. Guin, P.E. Consultant

ACCEPTANCE OF NOTICE OF AWARD

Receipt of the above Notice of Award is hereby acknowledged by _____

_____ this, the _____day of _____, 20___.

By _____

Title _____

NOTICE TO PROCEED

DATE:

TO: Company
Address
City, State, Zip

ATTN: Name

RE: GORDO WATER, GAS AND SEWER BOARD
SULLIVAN WATER TREATMENT PLANT REHABILITATION PROJECT
PHASE 2 – EQUIPMENT BUILIDNG & CLEARWELL REHAB

Dear _____,

You are hereby notified to commence Work in accordance with the Contract dated _____, on or before _____. You are to complete the Work within 300 consecutive calendar days from the effective date of this Notice to Proceed. The date of Final Completion is therefore _____. Assessment of liquidated damages in the amount as specified in the Contract Documents will be imposed for each calendar day the Work remains incomplete after _____. Liquidated damages, as defined herein, will be assessed unless the Contract Time is otherwise adjusted for due cause by change order to the Contract.

Please return a copy of this NOTICE TO PROCEED and ACCEPTANCE OF NOTICE to the undersigned indicating your receipt of this document in the space provided on the following page.

Sincerely,

GORDO WATER, GAS AND SEWER BOARD

_____
Honorable Craig Patterson, Mayor

ACCEPTANCE OF NOTICE TO PROCEED

Receipt of the above Notice to Proceed is hereby acknowledged by _____

_____ this, the _____ day of _____, 20____.

By _____

Title _____

CONTRACT CHANGE ORDER

OWNER: _____

CONTRACTOR: _____

PROJECT NAME: _____

DATE: _____ LOAN NUMBER: _____

CHANGE ORDER NUMBER: _____ CONTRACT NUMBER _____

REASON FOR CHANGE: _____

_____

YOU ARE HEREBY REQUESTED TO COMPLY WITH THE FOLLOWING CHANGES FROM THE CONTRACT PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS: (USE ADDITIONAL SHEETS IF REQUIRED)

ITEM NO.	DESCRIPTION OF CHANGE(S) (QUANTITIES, ETC.)	UNIT COST	TOTAL COST
TOTAL CONTRACT CHANGE			$
			TOTAL CONTRACT
ORIGINAL CONTRACT AMOUNT:			
CURRENT CONTRACT AMOUNT:			
THIS CONTRACT CHANGE:			
REVISED CONTRACT AMOUNT:			
CURRENT CONTRACT COMPLETION DATE:			
TIME EXTENSION REQUIRED BY CHANGE:			
REVISED CONTRACT COMPLETION DATE:			

THIS DOCUMENT SHALL BE AN AMENDMENT TO THE CONTRACT AND ALL PROVISIONS OF THE CONTRACT WILL APPLY.

RECOMMENDED BY: _____ _____
DATE

ACCEPTED BY: _____ _____
CONTRACTOR DATE

APPROVED BY: _____ _____
OWNER DATE

SECTION 00600

GENERAL CONDITIONS

ARTICLES

ARTICLE 1 — DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof.

Defined Terms:

1. Addenda: Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change, the Bidding Documents or the Contract Documents.

2. Agreement: The written agreement between Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

3. Application for Payment: The form accepted by the Owner which is to be used by Contractor in requesting progress or final payment and which is to include such supporting documentation as is required by the Contract Documents.

4. Bid: The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. Bidder: Any person, firm or corporation submitting a Bid for the Work.

6. Bidding Documents: Notice to bidders or advertisement, if any; instructions to bidders; other bidding information and requirements; bidding forms and attachments; contract and bond forms, and the proposed Contract Documents, including any addenda issued prior to receipt of bids.

7. Bonds: Bid, performance, and labor and material payment bonds and other instruments of security.

8. Change Order: A written order to the Contractor signed by the Owner authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued after the Effective Date of the Agreement that shall be approved in advance and set forth in the public minutes of the Owner.

9. Contract Documents: The Agreement, Addenda, the Advertisement for Bids, Contractor's Bid (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award when attached as an exhibit to the Agreement), the Bonds, these General Conditions, the Notice of Awards, the Notice to Proceed, the Supplementary Conditions, the Special Conditions, the Instructions to Bidders, the Technical Specifications, the Drawings as the same may be more specifically identified in the Agreement, together with all Modifications issued after execution of the Agreement.

10. Contract Price: The money payable by Owner to Contractor under the Contract Documents as stated in the Agreement.

11. Contract Time: The number of days (computed as provided in Paragraph 17.2) or

the date stated in the Agreement for the completion of the Work.

12. Contractor: The person, firm or corporation with whom Owner has executed the Agreement. Whenever the Project is to be constructed under multiple direct contracts, the term "Contractor" shall mean the appropriate prime Contractor. Whenever a specific prime Contractor is referred to, terms such as "General Contractor", "Electrical Contractor", etc. will be used.

13. Day: A calendar day of twenty-four hours measured from midnight to the next midnight.

14. Defective: An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to recommendation for final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.5).

15. Drawings: The Drawings which show the character and scope of the Work to be performed and which have been prepared or approved by Owner and are referred to in the Contract Documents.

16. Effective Date of the Agreement: The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

17. Engineer: The person, firm or corporation named as such in the Agreement.

18. Field Order: A written order issued by the Owner which orders minor changes in the Work in accordance with Paragraph 10.2 but which does not involve a change in the Contract Price or the Contract Time.

19. General Requirements: Sections of the Technical Specifications.

20. Modifications: (a) A written amendment of the Contract Documents signed by both parties, (b) a Change Order, or (c) a Field Order. A modification may only be issued after the Effective Date of the Agreement.

21. Notice of Award: The written notice by Owner to the apparent successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, Owner will sign and deliver the Agreement.

22. Notice to Proceed: A written notice given by Owner to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform his obligations under the Contract Documents.

23. Owner: The public body or authority, corporation, association, partnership, or individual with whom Contractor has entered into the Agreement and for whom

the Work is to be provided.

24. Project: The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

25. Project manual: The bond documentary information prepared for bidding and constructing the Project. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the tables of contents.

26. Resident Project Representative: The authorized representative of the Owner whom is assigned to the site or any part thereof.

27. Samples: Physical examples furnished by the Contractor to illustrate materials, equipment or ownership, and to establish standards by which some portions of the Work will be judged.

28. Shop Drawings: All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a manufacturer, fabricator, supplier or distributor and submitted by Contractor to illustrate material or equipment for some portion of the Work.

29. Subcontractor: An individual, firm or corporation having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

30. Substantial Completion: The Work for a specified part thereof has progressed to the point where, in the opinion of Owner as evidenced by Owner's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work for a specified part can be utilized for the purposes for which it was intended: or if there be no such certificate issued, when final payment is due in accordance with Paragraph 14.9.A. The terms "substantially complete" and "substantially completed" as applied to any Work refer to substantial completion thereof.

31. Supplementary Conditions: Modifications and additions to the General Conditions.

32. Technical Specifications: Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

33. Work: The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

34. Order of Precedence: The plans, standard specifications, general conditions, supplemental conditions, technical specifications and all supplemental plans and documents are essential parts of the Contract, and a requirement occurring in one is just as binding as though occurring in all. They are intended to be complementary and to describe and provide for the complete work. In case of discrepancy, computed dimensions, unless obviously incorrect, shall govern over scaled dimensions. Plans shall govern over standard specifications. Supplemental conditions shall govern over general conditions.

The Contractor shall not take advantage of any apparent error or omission in the plans. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately notify the Owner in writing requesting his interpretation and the Owner will make such corrections and decisions in writing as may be deemed necessary to carry out the intent of the plans.

ARTICLE 2 — PRELIMINARY MATTERS

2.1 Delivery of Bonds and Insurance Certificates:

A. When Contractor executes agreement with Owner, Contractor shall deliver to Owner such Bonds as Contractor may be required to furnish in accordance with Article 5.

B. When Contractor executes Agreement with Owner, Contractor shall deliver to Owner certificates (and other evidence of insurance requested by Owner) which Contractor is required to purchase and sustain in accordance with Article 5, and Owner shall deliver to Contractor certificates (and other evidence of insurance requested by Contractor) which Owner is required to purchase and maintain in accordance with Article 5.

2.2 Copies of Documents: Owner shall furnish to Contractor up to five copies (unless otherwise provided in the General Requirements) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

2.3 Commencement of Contract Times — Notice to Proceed: The Contract Time will commence to run on the tenth day after the Effective Date of the Agreements or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceeds but in no event shall the Contract Time commence to run later than the tenth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement.

2.4 Starting the Project: Contractor shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

2.5 Before Starting Construction:

A. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to the Owner any conflict, error or discrepancy which he may discover and shall obtain a written

interpretation or clarification from the Owner before proceeding with any Work affected thereby however, Contractor shall not be liable to Owner for the failure to report any conflict, error or discrepancy in the Contract Documents, unless Contractor had actual knowledge thereof or should reasonably have known thereof.

B. Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements) Contractor shall submit to the Owner for review and acceptance, an estimated progress schedule indicating the starting and completion dates of the various stages of the Work, a preliminary schedule of Shop Drawing submissions, and a preliminary schedule of values of the Work.

C. The Contractor shall deliver to the Owner, with his signed Contract, all bonds and insurance which he is required to purchase and maintain in accordance with Article 5. The Owner shall deliver to the Contractor a copy of all policies of insurance which the Owner is required to purchase and maintain in accordance with Article 5.

2.6 Preconstruction Conference: Within ten days after the Effective Date of the Agreement, but before Contractor starts the Work at the site, a conference will be held for review and acceptance of the schedules, referred to in Paragraph 2.5.B, to establish procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

ARTICLE 3 — CONTRACT DOCUMENTS: INTENT AND REUSE

3.1 Intent:

A. The Contract Documents comprise the entire Agreement between Owner and Contractor concerning the Work. They may be altered only by a written modification through a change order duly signed in advance of contract work necessitated by such modification and set forth in the public minutes of Owner**.**

B. The Contract Documents are complementary meaning that what is called for by one is as binding as if called for by all. If during the performance of the Work, Contractor finds a conflict, error or discrepancy in the Contract Documents, he shall report it to the Owner in writing at once and before proceeding with the Work affected thereby however, Contractor shall not be liable to Owner for failure to report any conflict, error or discrepancy in the Specifications or Drawings unless Contractor had actual knowledge thereof or should reasonably have known thereof.

C. It is the intent of the Specifications and Drawings to describe a complete Project or part thereof to be constructed in accordance with the Contract Documents. Any Work that may reasonably be inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for at no additional cost to Owner**.**

D. The Specifications may describe or the Drawings may show the general arrangement of an item of material or equipment when the actual details of said arrangement will vary with the source of the material or equipment. In such cases, Contractor shall bear all direct and indirect costs to accommodate the item of material or equipment furnished, whether the item of material or equipment is furnished by a manufacturer named in the

Specifications or is furnished as an approved substitute or for an equal item of material or equipment.

E. When words in the Specifications or on the Drawings, which have a well known technical or trade meaning, are used to describe Work, materials or equipment such words shall be interpreted in accordance with such meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the code of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual or code in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties and responsibilities of Owner, Contractor, or any of their agents or employees from those set forth in the Contract Documents. Clarifications and interpretations of the Contract Documents shall be issued by Owner as provided for in Paragraph 9.3.

F. The Contract Documents will be governed by the law of the place of the Project.

3.2 Re-use of Documents: Neither Contractor nor any Subcontractor, manufacturer, fabricator, supplier or distributor shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents for copies of any thereof prepared by or bearing the seal of Engineer and they shall not reuse any of them on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

ARTICLE 4 — AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; AND REFERENCE POINTS

4.1 Availability of Lands: Owner shall furnish, as indicated in the Contract Documents the lands upon which the Work is to be performed, rights-of-way for access thereto, and such other lands which are designated for the use of Contractor. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by Owner, unless otherwise provided in the Contract Documents. If Contractor believes that any delay in Owner's furnishing these lands or easements entitles Contractor to an extension of the Contract Time, Contractor may make a claim therefore as provided in Article 12. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2 Physical Conditions-Investigations and Reports: Reference is made to the Supplementary Conditions for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or those reports that otherwise may affect cost, progress or performance of the Work which have been utilized by the Owner in preparation of the Drawings and Specifications. These reports are not intended to constitute any explicit or implicit representation as to the nature of the subsurface and latent physical conditions which may be encountered at the site or to constitute explicit or implicit representations as to any other matter contained in any report. Such reports are not guaranteed as to accuracy or completeness and are not part of the contract Documents.

4.3 Unforeseen Physical Conditions: Contractor shall promptly notify the Owner in writing of any subsurface or latent physical conditions at the site or in an existing structure differing materially from those indicated or referred to in the Contract Documents. The Owner will promptly review those conditions and advise, in writing if further investigations or tests are necessary. Promptly thereafter, Owner shall obtain the necessary additional investigations and tests and furnish copies to Owner and Contractor. If the Owner finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by Contractor, a Change Order shall be issued incorporating the necessary revisions.

4.4 Reference Points: Owner shall provide engineering surveys for construction to establish reference points which in Owner's judgment are necessary to enable Contractor to proceed with the work. Contractor shall be responsible for laying out the Work (unless otherwise specified in the General Requirements), and shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Owner whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5 — BONDS AND INSURANCE

5.1 Performance, Payment and Other Bonds:

A. Contractor shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date of final payment, except as otherwise provided by law. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the forms prescribed by the Bidding Documents or Supplementary Conditions and be executed by such sureties as:

1. Are licensed to conduct business in the state where the Project is located, and

2. Are named in the current list of Companies Holding Certificates of Authority as "Acceptable Sureties on Federal Bonds" and as "Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

B. If the surety of any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminating any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.l.A, Contractor shall within five days thereafter substitute another Bond and surety, both of which shall be acceptable to Owner.

C. The Contractor shall procure and maintain at his own expense any additional kinds and amounts of insurance that, in his own judgment, may be necessary for his proper reaction in the protection in the prosecution of the Work. The Contractor shall carry insurance as prescribed herein and all policies shall be with companies satisfactory to the Owner. If a part of this Contract is sublet, the Contractor shall require each Subcontractor to carry

insurance of the same kinds and in like amount as carried by the Contractor. Certificates of insurance shall state that 10 days written notice will be given to the Owner before the policy is cancelled or changed. No Contractor or Subcontractor will be allowed to start any construction work on this Contract until certificates of all insurance required herein are filed and approved by the Owner. The certificates shall show the type, amount, class of operations covered, effective dates and the dates of expiration of policies. The Contractor shall secure and maintain in effect for the period of the Contract and pay all premiums for the following kinds and amounts of insurance.

D. This insurance shall protect the Contractor against all claims under applicable State Worker's Compensation Laws. The Contractor shall also be protected and shall cause each Subcontractor to be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a Worker's Compensation Law. The liability limits shall not be less than the required statutory limits for Worker's Compensation. Employer's Liability shall be in the amount of ONE MILLION DOLLARS ($1,000,000.00) each accident, ONE MILLION DOLLARS ($1,000,000.00) Disease – policy limit, & ONE MILLION DOLLARS ($1,000,000.00) Disease – each employee limit. This policy shall include an all states endorsement.

E. Contractor’s Comprehensive Liability Insurance covering all operations in connection with the performance if this Contract in amounts not less than the following:

General Aggregate: FIVE MILLION DOLLARS ($5,000,000.00), Products & completed Operations Aggregate: FIVE MILLION DOLLARS ($5,000,000.00), Personal & Advertising Injury: ONE MILLION DOLLARS ($1,000,000.00), Each occurrence: ONE MILLION DOLLARS ($1,000,000.00).

The Comprehensive Public Liability and Property Damage policies carried by both the Contractor and the Subcontractors shall contain an endorsement to include the coverage of the following hazards:

1. Explosion, collapse, and underground property damage to include any damage or destruction of property below the surface of the ground, such as wires, conduits, pipes, mains, sewers, etc., caused by the Contractor’s operations.
2. The collapse of and structural injury to any building, structure or property on or adjacent to the Owner’s premises or right-of-way caused by the Contractor’s operations in the removal of other buildings, structures, or supports, or by excavation below the surface of the ground.
3. Contractual Liability Coverage for the Hold Harmless segments of the Contract Documents.

F. Contractor’s Contingent or Protective Liability and Property Damage:

In case part of this Contract is sublet, the Contractor shall secure contingent or protective liability and property damage insurance to protect him from any and all claims arising from the operation of his Subcontractors in the execution of Work included in the Contract. In no case shall the amount of such protection be less than the limits specified above in Sections “D” & “F”.

G. Automotive Public Liability and Property Damage

The Contractor shall maintain automobile public liability insurance in the amount of not less than ONE MILLION DOLLARS ($1,000,000) for injury to one person and ONE MILLION DOLLARS ($1,000,000) for one accident; and automobile property damage insurance in the amount of not less than ONE MILLION DOLLARS ($1,000,000) for one accident to protect him from any and all claims arising from the use of the following:

1. Contractor's own automobiles and trucks
2. Hired automobiles and trucks
3. Non-Owned Vehicles

The aforementioned is to cover use of automobiles and trucks on and off the site of the Project.

The Owner shall be provided an endorsement from the insurer naming the Owner as an insured for the work contracted.

H. Owner's Protective Liability Policy

The Contractor shall maintain Owner's Protective Liability Insurance with the Owner as the named insured, and the Engineer, and their servants, agents and employees as additional insureds in amounts not less than the following:

1. Bodily Injury in the amount of ONE MILLION DOLLARS ($1,000,000) for each person and ONE MILLION DOLLARS ($1,000,000) for each accident and property damage liability in the amount of ONE MILLION DOLLARS ($1,000,000) for all damages arising out of an injury or destruction of property in any one accident and subject to that limit per accident a total (or aggregate) limit of ONE MILLION DOLLARS ($l,000,000) for all damages arising out of injury to or destruction of property during the policy period.

I. Builder's Risk Insurance Fire and Extended Coverage

Until the project is completed and is accepted by the Owner, the Contractor is required to maintain Builder's Risk Insurance (fire and extended coverage) adequate to fully cover the insurable portion of the project for the benefit of the Owner, the Contractor and Subcontractors as their interests may appear.

5.2 Contractor's Liability Insurance:

A. Contractor shall purchase and maintain such comprehensive general liability and other insurance as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether such performance of the Work is by Contractor, by any Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Claims under workers' or workmen's compensation, disability benefits and other similar employee benefit acts:
2. Claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees:

3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees:
4. Claims for damages insured by personal injury liability coverage which are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (b) by any other person for any other reason.
5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefore.
6. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
7. Claims for damages because of bodily injury or death of any person arising out of operation of law.
8. Contractor shall have an umbrella policy with limits of TWO MILLION DOLLARS ($2,000,000) each occurrence.
9. The insurance company shall have an AM Best rating of at least B++.

B. The insurance required by Paragraph 5.2.A shall include the specific coverages and be written for not less than the limits of liability and coverages provided in the Supplementary Conditions, or required by law, whichever is greater. All such insurance shall remain in effect until final payment and at all times thereafter when Contractor may be correcting, removing or replacing defective Work in accordance with Paragraph 13.9. The comprehensive general liability insurance shall include completed operations insurance and shall include Owner and Engineer and their agents and employees as additional insureds. Contractor shall maintain such completed operations insurance for at least two years after final payment and shall furnish Owner with evidence of continuation of such insurance at final payment and one year thereafter.

5.3 Contractual Liability Insurance: The comprehensive general liability insurance required by Paragraph 5.2.A shall include contractual liability insurance applicable to Contractor's obligations under Paragraph 6.15.

5.4 Owner's Liability Insurance: Owner shall be responsible for purchasing and maintaining Owner's own liability insurance and, at Owner's option, may purchase and maintain such insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.5 Property Insurance:

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or as required by law). This insurance shall include the interests of the Engineer, Contractor, and Subcontractors in the Work, shall insure against the perils of fire and extended coverage shall include tail risks insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and such other perils as may be specified in the Supplementary Conditions shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including fees and charges of engineers, architects, attorneys and other professionals) and shall provide that all insurance proceeds are to be paid to Owner "as Trustee". If not covered under the "all risk" insurance or otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain similar property insurance on portions of the Work stored on or off the site or in transit when such portions of the Work are to be included in an Application for Payment.

B. Owner shall purchase and maintain such boiler and machinery insurance as may be required by the Supplementary Conditions or by law. This insurance shall include the interest of Owner, Contractor and Subcontractors in the Work. Owner shall file a copy of all policies required by this Paragraph with Contractor before an exposure to loss may occur.

C. The policies of insurance required under this Paragraph 5.5 shall provide that neither the Owner nor the Contractor, nor their insurers, shall have any right of subrogation against any of the other parties enumerated in Paragraph 5.6. It is the intention of the Owner and Contractor that the policies shall protect all of the enumerated parties and be primary coverage for any and all losses covered by the insurance described in Paragraphs 5.5.A and 5.5.B.

5.6 Waiver of Rights: Owner and Contractor waive all rights against each other and the Subcontractors and their agents and employees and against Engineer and separate contractors (if any) and their subcontractors', agent and employees, for damages caused by fire or other perils to the extent covered by insurance provided under Paragraph 5.5., or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance held by Owner as trustee. Owner or Contractor, as appropriate, shall require similar waivers in writing by Engineer and from each separate contractor and each Subcontractor, each such waiver will be in favor of all other parties enumerated in this Paragraph 5.6.

5.7 Receipt and Application of Proceeds:

A. Any insured loss under the policies of insurance required by Paragraph 5.5 shall be adjusted with Owner and made payable to Owner as trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.7.B. Owner shall deposit in a separate account any money so received, and he shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after each occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as trustee shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If required in writing by any party in interest, Owner as trustee shall upon the occurrence of an insured loss, give bond for the proper performance of his duties.

5.8 Partial Utilization — Property Insurance: If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all of the Work, such use or occupancy may be accomplished in accordance with Paragraph 14.6; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or lapse on account of any such partial use or occupancy.

5.9 Certificates of Insurance: All certificates of the insurance required to be purchased by Contractor pursuant to Article 5 shall be filed in accordance with Paragraph 2.1.B. Certificates shall be acceptable to Owner and shall contain a provision that coverages afforded under the policies will not be canceled, materially changed or renewal refused until at least thirty days' prior written notice has been given to Owner by certified mail.

5.10 Additional Bonds and Insurance: Owner may require Contractor to furnish such other Bonds and such additional insurance, in such form and with such sureties or insurers as Owner may specify. If such other Bonds or such other insurance are specified in the Contract Documents, the premiums shall be paid by Contractor. If subsequent thereto, they shall be paid by Owner except as otherwise provided in Paragraph 6.3.A and Paragraph 13.8.B.

5.11 Owner as Additional Insured: The Owner shall be named as additional insured on all insurance policies provided by the Contractor for ongoing and completed operations for a period of 2 years.

ARTICLE 6 — CONTRACTOR'S RESPONSIBILITIES

6.1 Supervision and Superintendence:

A. Contractor will supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but he shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

B. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to Owner except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to Contractor.

6.2 Labor, Materials and Equipment:

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Supplementary Conditions, all Work at the site shall be performed during regular working hours, and Contractor will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without Owner's written consent given.

B. Contractor shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances and all other facilities and incidentals necessary for the execution, testing, initial operation and completion of the Work. Except as otherwise specified in the General Requirements, Contractor shall furnish all fuel, power, light, heat, telephone, water and sanitary facilities necessary for the execution, testing, initial operation and completion of the Work.

C. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Owner, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment.

D. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents but no provision of any such instructions will be effective to impose on Owner responsibility for the means, methods, techniques, sequences or procedures of construction or for safety precautions incident thereto.

6.3 Substitutions: Whenever materials or equipment are specified or described in the Drawings or Specifications by using the name of a proprietary item or the name of a particular manufacturer, fabricator, supplier or distributor, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other manufacturers, fabricators, suppliers or distributors may be accepted by Owner if sufficient information is submitted by Contractor to allow Owner to determine that the material or equipment proposed is equivalent to that named. The procedure for review by Owner will be as set forth in Paragraphs 6.3.A and 6.3.B below and as supplemented in the General Requirements.

A. Requests for review of substitute items of material and equipment will not be accepted by Owner from anyone other than Contractor. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall make written application to Owner for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice Contractor's timely achievement of Substantial Completion, whether or not acceptance of the substitute for use in the Work will require a change in

the Drawings or Specifications to adapt the design to the substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain a statement that Contractor agrees to pay all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change. Owner may require Contractor to furnish at Contractor's expense additional data about the proposed substitute. Owner will be allowed a reasonable time within which to evaluate the proposed substitute. Owner will be sole judge of acceptability and no substitute will be ordered or installed without Owner's prior written acceptance. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

B. Owner will record time required by Owner's consultants in evaluating substitutions proposed by Contractor and in making changes in the Drawings or Specifications occasioned thereby, whether or not Owner accepts a proposed substitute, Contractor shall reimburse Owner for the charges of Owner's consultants for evaluating any proposed substitute that does not meet the requirements of the Drawings and Specifications.

6.4 Concerning Subcontractors:

A. Contractor shall not employ any Subcontractor or other person or organization (including those who are to furnish the principal items of materials or equipment), whether initially or as a substitute, against whom Owner may have reasonable objection. A Subcontractor or other person or organization identified in writing to Owner by Contractor prior to the Notice of Award and not objected to in writing by Owner prior to the Notice of Award will be deemed acceptable to Owner. If Owner after due investigation has reasonable objection to any Subcontractor, other person or organization proposed by Contractor after the Notice of Award, Contractor shall submit an acceptable substitute and the Contract Price shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued. Contractor shall not be required to employ any Subcontractor, other person or organization against whom Contractor has reasonable objection. Acceptance of any Subcontractor, other person or organization by Owner shall not constitute a waiver of any right of Owner to reject defective work.

B. Contractor shall be fully responsible for all acts and omissions of his Subcontractors and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that Contractor is responsible for the acts and omissions of persons directly employed by Contractor. Nothing in the Contract Documents shall create any contractual relationship between Owner and any Subcontractor or other person or organization having a direct contract with Contractor, nor shall it create any obligation on the part of Owner to pay or to see to the payment of any moneys due any Subcontractor or other person or organization, except as may otherwise be required by law. Owner may furnish to any Subcontractor or other person or organization, to the extent practicable, evidence of amounts paid to Contractor on account of specific work done.

C. The Divisions and Sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or delineating the Work to be performed by any specific trade.

D. All Work performed for Contractor by a Subcontractor will be pursuant to an appropriate agreement between Contractor and the Subcontractor which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of Owner and contains waiver provisions as required by Paragraph 5.6. Contractor shall pay each Subcontractor a just share of any insurance moneys received by Contractor on account of losses under policies issued pursuant to Paragraph 5.5.

6.5 Patent Fees and Royalties: Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents. Contractor shall indemnify and hold harmless Owner and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

6.6 Permits: Unless otherwise indicated in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bid. Contractor shall also pay all charges of utility service companies for connections to the Work, and Owner shall pay all charges of such companies for capital costs related thereto.

6.7 Laws and Regulations: Contractor shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If Contractor observes that the Specifications or Drawings are at variance therewith, Contractor shall give Owner prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If Contractor performs any Work knowing or having reason to know that it is contrary to such laws, ordinances, rules and regulations, and without such notice to Owner, Contractor shall bear all costs arising therefrom; however, it shall not be Contractor’s primary responsibility to make certain that the Specifications and Drawings are in accordance with such laws, ordinances, rules and regulations.

6.8 Taxes: Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by him in accordance with the law of the place of the Project.

6.9 Use of Premises:

A. Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workmen to areas permitted by law, ordinances, permits, or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment.

B. During progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by Owner. Contractor shall restore to their original condition those portions of the site not designated for alternation by the Contract Documents.

C. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.10 Record Documents: Contractor shall keep one record copy of all Specifications, Drawings, Addenda, Modifications, Shop Drawings, and Samples at the site in good order, and annotated to show all changes made during the construction process. These shall be available to Owner for examination and shall be delivered to Owner upon completion of the Work. Contractor shall provide accurate 'mark ups' acceptable to the Owner on or before the date of Substantial Completion of the Project for use by the Owner in the preparation of 'record' drawings. Final payment will not be made to the Contractor prior to the Owner receiving these marks-ups from the Contractor.

6.11 Safety and Protection:

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

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

B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders or any public body having jurisdiction for the safety of persons or property or to protect then from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and utilities when prosecution of the Work may affect them. Contractor shall cooperate with the utility owner in the protection, removal, relocation, or replacement of such utility property. All damage, injury or loss to any property referred to in Paragraph 6.11.A.2 or 6.11.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor). Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is

completed and Owner has issued a notice to Owner and Contractor in accordance with Paragraph 14.9 that the Work is acceptable.

C. Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to Owner.

6.12 Emergencies: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without Special instruction or authorization from Owner, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Owner prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby.

6.13 Shop Drawings and Samples:

A. After checking and verifying all field measurements, Contractor shall Submit to Owner for review and approval, in accordance with the accepted schedule of Shop Drawing submissions (See Paragraph 2.6) and the procedures specified in the General Requirements, copies of all Shop Drawings, which shall have been checked by and stamped with the approval of Contractor and identified as Owner may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable Owner to review the information as required.

B. Contractor shall also submit to Owner for review and approval with such promptness as to cause no delay in Work, all Samples required by the Contract Documents. All Samples will have been checked by and stamped with the approval of Contractor, identified clearly as to material, manufacturer, and pertinent catalog numbers and the use for which intended.

C. At the time of each submission, Contractor shall in writing call Owner's attention to all deviations that the Shop Drawings or Samples may have from the requirements of the Contract Documents.

D. Owner will review and approve with reasonable promptness Shop Drawings and Samples, but Owner's review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make any corrections required by Owner and shall return the required number of corrected copies of Shop Drawings and resubmit new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Owner on previous submittals. Contractor's stamp of approval on any Shop Drawing or Sample shall constitute a representation to Owner that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so and that Contractor has reviewed or coordinated each Shop Drawing or Sample with the requirements of the Work and the Contract Documents.

E. Where a Shop Drawing or Sample is required by the Specifications, no related Work shall be commenced until the submittal has been reviewed and approved by Owner.

F. Owner's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any deviations from the Contract Documents unless Contractor has in writing called Owner's attention to such deviation at the time of submission and Owner has given written concurrence and approval to the specific deviation, nor shall any concurrence and approval by Owner relieve Contractor from responsibility for errors or omissions in the Shop Drawings or Samples.

6.14 Continuing The Work: Contractor shall carry on the Work and maintain the progress schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as Contractor and Owner may otherwise agree in writing.

6.15 Indemnification:

A. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless Owner and their agents, employees and consultants from and against all claims, damages, losses and expenses including, but not limited to attorneys' fees arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom and (2) is caused in whole or in part by either

(a) any negligent act or omission of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable regardless of whether or not it is caused in part by a party indemnified hereunder, or

(b) arises out of operation of law as a consequence of any act or omission of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether any of them has been negligent.

B. In any and all claims against Owner or any of their agents, employees or consultants by any employee of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.15.A shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The obligations of Contractor under Paragraph 6.15.A shall not extend to the liability of Owner, his agents, employees or consultants arising out of the Owner's preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

ARTICLE 7 — WORK BY OTHERS

7.1 Owner may perform additional work related to the Project by himself, or have additional work performed by utility service companies, or let other direct contracts therefore which shall contain General Conditions similar to these. Contractor shall afford the utility service companies and the other contractors who are parties to such direct contracts (or Owner, if Owner is performing the additional work with Owner's employees) reasonable opportunity for the introduction and storage of materials and equipment and the execution of work, and shall properly connect and coordinate his Work with theirs.

7.2 If any part of Contractor's Work depends for proper execution or results upon the work of any such other contractor or utility service company (or Owner), Contractor shall inspect and promptly report to Owner in writing any patent or apparent defects or deficiencies in such work that render it unsuitable for such proper execution and results. Contractor's failure to so report shall constitute an acceptance of the other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in the other work.

7.3 Contractor shall do all cutting, fitting and patching of his Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner and the others whose work will be affected.

7.4 If the performance of additional work by other contractors or utility service companies or Owner was not noted in the Contract Documents, written notice thereof shall be given to Contractor prior to starting any such additional work. If Contractor believes that the performance of such additional work by Owner or others involves additional expense or requires an extension of the Contract Time, Contractor may make a claim therefore as provided in Articles 11 and 12 provided that the Contractor will make no claim which is barred by the provisions of Paragraph 12.3.

ARTICLE 8 — OWNER'S RESPONSIBILITIES

8.1 Owner shall issue all communications to Contractor through Owner.

8.2 N/A

8.3 Owner shall furnish the data required of Owner under the Contract Documents promptly and shall make payments to Contractor promptly after they are due as provided in Paragraphs 14.4.A and 14.9.A.

8.4 Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.1 and 4.4. Paragraph 4.2 refers to Owner's identifying and making available to Contractor copies of reports of investigations and tests of subsurface and latent physical conditions at the site or those reports that otherwise may affect performance of the Work which has been utilized by Owner in preparing the Drawings and Specifications.

8.5 Owner's responsibilities in respect of purchasing and maintaining insurance are set forth in Article 5.

8.6 In connection with Owner's rights to request changes in the Work in accordance with Article 10, Owner (especially in certain instances as provided in Paragraph 10.4) is obligated to execute Change Orders.

8.7 Owner's responsibility in respect of certain inspections, tests and approvals is set forth in Paragraph 13.3.

8.8 In connection with Owner's right to stop Work or suspend Work, see Paragraphs 13.5 and 15.1. Paragraph 15.2.A deals with Owner's right to terminate services of Contractor under some circumstances.

ARTICLE 9 — ENGINEER'S STATUS DURING CONSTRUCTION

9.1 Owner's Representative: Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

9.2 Visits to Site: Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Engineer shall make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. On the basis of such visits and on-site observations, Engineer will inform Owner of the progress of the Work and will endeavor to guard Owner against defects and deficiencies in the Work.

9.3 Clarifications and Interpretations: Engineer will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents (in the form of Drawings or otherwise) as Engineer may determine necessary, which shall be consistent with or reasonably inferable from the overall Intent of the Contract Documents. If Contractor believes that a written clarification or interpretation justifies an increase in the Contract Price or Contract Time, Contractor may make a claim therefore as provided in articles 11 and 12.

9.4 Rejecting Defective Work: Engineer will have authority to disapprove or reject Work which Engineer believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in Article 13, whether or not the Work is fabricated, installed or completed.

9.5 Project Representation: If Owner and Engineer agree, Engineer will designate a Resident Project Representative to assist Engineer in observing the performance of the Work. The duties, responsibilities and limitations of authority of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions. If Owner designates another agent to represent him at the site who is not Engineer's agent or employee, the duties, responsibilities and limitations of authority of such other person will be as set forth in the Supplementary Conditions.

9.6 Decisions on Disagreements:

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder: Claims, disputes and other matters

relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work shall be referred initially to Engineer in writing with a request for a formal decision in accordance with this Paragraph, which Engineer will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter shall be delivered by the claimant to Engineer and the other party to the Agreement within fifteen days of the occurrence of the event giving rise thereto and written supporting data will be submitted to Engineer and the other party within forty-five days of such occurrence unless Engineer allows an additional period of time to ascertain more accurate data. In his capacity as interpreter and judge, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

B. The rendering of a decision by Engineer pursuant to Paragraph 9.6.A with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 14.9) will be a condition precedent to any exercise by Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or at law in respect of any such claim, dispute or other matter.

9.7 Limitations on Engineer's Responsibilities:

A. Neither Engineer’s authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of Engineer to Contractor, any Subcontractor, any manufacturer, fabricator, supplier or distributor or any of their agents or employees or any other person performing any of the Work.

B. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper", or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of Engineer as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective never indicates that Engineer shall have authority to supervise or direct performance of the Work or authority to undertake responsibility contrary to the provisions of Paragraphs 9.7.C and 9.7.D.

C. Engineer will not be responsible for Contractor’s means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and Engineer will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents. When it comes to his attention, the Engineer will immediately notify the Owner in the event that the Contractor is not complying with the Contract Documents or is conducting the Work in such a manner that could be considered ground for termination of the Contract. The Contractor shall retain responsibility for performing all Work in compliance with the Contract Documents.

D. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractors, or of the agents or employees of any Contractor or Subcontractor, or of any other persons at the site or otherwise performing any of the Work.

ARTICLE 10 — CHANGES IN THE WORK

10.1 Without invalidating the Agreement, Owner may, at any time or from time to time, order additions, deletions or revisions in the work; these will be authorized by written Change Orders only; duly signed in advance by the parties and set forth in the public minutes of the Owner. Upon receipt of a Change Order, Contractor shall proceed with the Work involved. All such work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 11 or Article 12 on the basis on a claim made by either party.

10.2 Owner may authorize minor changes in the Work not involving an adjustment in the Contract Price or the Contract Time which are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order and shall be binding on Owner, and also on Contractor who shall perform the change promptly. If Contractor believes that a Field Order Justifies an increase in the Contract Price or Contract Time, Contractor may make a claim therefore as provided in Article 11 or Article 12.

10.3 Additional Work performed without authorization of a Change Order will not entitle Contractor to an increase in the Contract Price or an extension of the Contract Time, except as in the case of an emergency as provided in Paragraph 6.12.

10.4 Owner shall execute appropriate written Change Orders prepared by Owner covering changes in the Work which are required by Owner, or required because of unforeseen physical conditions or emergencies, or because of uncovering work found not to be defective, or as provided in Paragraphs 11.6 and 15.1.

10.5 If notice of any changes affecting the general scope of the Work or change in the Contract Price is required by the provisions of any Bond to be given to the surety, it will be Contractor's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. Contractor shall furnish proof of such adjustment to Owner.

ARTICLE 11 — CHANGE OF CONTRACT PRICE

11.1 The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at his expense without change in the Contract Price.

11.2 The Contract Price may only be changed by a written Change Order duly signed in advance by the parties and set forth in the public minutes of the Owner. Any claim for an increase in the Contract Price shall be based on written notice delivered to Owner within fifteen days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within forty-five days of such occurrence unless Owner allows an additional period of time to ascertain accurate cost data. All claims for adjustment in the Contract Price shall be determined by Owner. Any change in the Contract Price resulting from any such claim shall be incorporated in a written Change Order.

11.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the ways listed herein.

A. Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.

B. By mutual acceptance of a lump sum.

C. On the basis of the Cost of the Work (determined as provided in Paragraph 11.4) plus a Contractor's Fee for overhead and profit (determined as provided in Paragraph 11.5).

D. Whenever the cost of any Work is to be determined pursuant to Paragraphs 11.4.A and 11.4.B, Contractor will submit in form acceptable to Owner, an itemized cost breakdown together with supporting data.

11.4 Cost of the Work

A. The term Cost of the Work means the sum of all costs necessarily incurred and paid by Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing in advance by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in Paragraph 11.4.B.

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foremen at the site. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to the Subcontractors for work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from Subcontractors acceptable to Contractor and shall deliver such bids to Owner who will then determine, with the advice of Owner, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Subcontractor's Cost of the Work shall be determined in the same manner as Contractor’s Cost of the Work. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

4. Costs of special consultants (including, but not limited to, engineers, architects, testing laboratories, surveyors, lawyers and accountants) employed for services specifically related to the work.

5. Supplemental costs including the following:

   a. The proportion of necessary transportation, travel and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the work.
   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workmen, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of Contractor.
   c. Rentals of all construction equipment and machinery and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof--all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.
   d. Sales, use or similar taxes related to the Work, and for which Contractor is liable, imposed by any governmental authority.
   e. Deposits lost for causes other than Contractor's negligence, royalty payments and fees for permits and licenses.
   f. Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by Contractor in connection with the execution of the Work, provided they have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of the Owner. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee. If, however, any such loss or damage requires reconstruction and Contractor is placed in charge thereof, Contractor shall be paid for services a fee proportionate to that stated in Paragraph 11.5
   g. The cost of utilities, fuel and sanitary facilities at the site.
   h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.
   i. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

B. The Term Cost of the Work shall not include any of the following:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by

Contractor whether at the site or in his principal or a branch office for general administration of the work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.4.A.1 — all of which are to be considered administrative costs covered by the Contractor's Fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Cost of premiums for all Bonds and for all insurance whether or not Contractor is required by the Contract Documents to purchase and maintain the same (except for additional Bonds and insurance required because of changes in the Work).

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 11.4.A.

11.5 Contractor's Fee:

A. The Contractor's Fee allowed to Contractor for overhead and profit shall be determined as follows:

1. A mutually acceptable fixed fee; or if none can be agreed upon,
2. A fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 11.4.A.1 and 11.4.A.2, the Contractor's Fee shall not exceed a total of twenty percent for overhead and for profit.

b. For costs incurred under Paragraph 11.4.A.3, the Contractor's Fee shall not exceed a total of five percent; and if a subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to the Subcontractor as a fee for overhead and profit shall not exceed a total of twenty percent.

c. No fee shall be payable on the basis of costs itemized under Paragraphs 11.4.A.4, 11.4.A.5 and 11.4.B.

B. The amount of credit to be allowed by Contractor to Owner for any such change which results in a net decrease in cost, will be the net decrease in Cost of the Work plus ten percent of the net decrease in the Cost of the Work. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net increase, if any.

11.6 Cash Allowances: It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done

by such Subcontractors, manufacturers, fabricators, suppliers or distributors and for such sums within the limit of the allowances as may be acceptable to Owner. Upon final payment, the Contract Price shall be adjusted as required and an appropriate Change Order issued. Contractor agrees that the original Contract Price includes such sums as Contractor deems proper for costs and profit on account of cash allowances. No demand for additional cost or profit in connection therewith will be allowed.

ARTICLE 12 — CHANGE OF THE CONTRACT TIME

12.1 The Contract Time may only be changed by a written Change Order approved in advance by the parties and set forth in Owner**'s** public minutes. Any claim for an extension in the Contract Time shall be based on written notice delivered to Owner within fifteen days of the occurrence of the event giving rise to the claim. Notice of the extent of the claim with supporting data shall be delivered within forty-five days of such occurrence unless Owner allows an additional period of time to ascertain more accurate data. All claims for adjustment in the Contract Time shall be determined by Owner. Any change in the Contract Time resulting from any such claim shall be incorporated in a written Change Order as set forth above.

12.2 The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of Contractor if a claim is made therefore as provided in Paragraph 12.1. Such delays shall include, but not be limited to, acts or neglect by Owner or others performing additional work as contemplated by Article 7, or to fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God. No extension of the Contract Time will be granted where the delay is attributable to a Subcontractor, manufacturer, fabricator, supplier or distributor or any other party performing services or furnishing material or equipment on behalf of the Contractor unless such party's delay is attributable to one of the above enumerated causes. Rainstorms which are encountered in the project area on a regular and seasonal basis do not constitute an abnormal weather condition.

12.3 The time limits concerning Substantial Completion and final completion as stated in the Contract Documents are of the essence. The provisions of this Article 12 shall not exclude recovery for damages (including compensation for additional professional services) for delay by either party, provided, however that Contractor shall not be entitled to damages for any delay occurring as a consequence of a delay in additional work being performed by others pursuant to Paragraph 7.1 hereof if the performance of said additional work was noted in the Contract Documents and the delay (by others) was not directly caused by the fault of Owner.

ARTICLE 13 — WARRANTY AND GUARANTEE; TESTS AND INSPECTION; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1 Warranty and Guarantee: Contractor warrants and guarantees to Owner that all work will be in strict accordance with the Contract Documents and will not be defective. Prompt notice after discovery of all defects shall be given to Contractor. All defective Work, whether or not in place, may be rejected or corrected as provided in this Article 13.

13.2 Access to Work: Owner and other representatives of Owner, testing agencies and governmental agencies with Jurisdictional Interests will have access to the Work at reasonable times for their observation, inspection and testing. Contractor shall provide proper and safe conditions for such access.

13.3 Tests and Inspections:

A. Contractor shall give Owner timely notice of readiness of the Work for all required inspections, tests or approvals.

B. If any law, ordinance, rule, regulation, code, or orders of any public body having jurisdiction requires any Work (or part thereof) to specifically be inspected, tested or approved, Contractor (unless another party is specified in the General Requirements) shall assume full responsibility therefore, pay all costs in connection therewith and furnish Owner the required certificates of inspection, testing or approval. Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing required by the Specifications in connection with Owner's acceptance of a manufacturer, fabricator, supplier or distributor of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. The cost of all other inspections, tests and approvals required by the Contract Documents shall be paid by Owner (unless otherwise specified).

C. All inspections, tests or approvals other than those required by law ordinance, rule, regulation, code or order of any public body having Jurisdiction shall be performed by organizations acceptable to Owner.

D. If any Work that is to be inspected, tested or approved is covered without written concurrence of Owner, it must, if requested by Owner, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Owner timely notice of Contractor's intention to cover such Work and Owner has not acted with reasonable promptness in response to such notice.

E. Neither observations by Owner nor inspections, tests or approvals by others shall relieve Contractor from his obligations to perform the Work in accordance with the Contract Documents.

13.4 Uncovering Work:

A. If any Work is covered contrary to the written request of Owner, it must, if requested by Owner, be uncovered for Owner's observation and replaced at Contractor's expense.

B. If Owner considers it necessary or advisable that covered Work be observed by Owner or inspected or tested by others, Contractor, at Owner's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Owner may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services, and an appropriate deductive Change Order shall be issued. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction if he makes a claim therefore as provided in Articles 11 and 12.

13.5 Owner May Stop the Work: If the Work is defective, or Contractor fails to supply sufficient skilled Workmen or suitable materials or equipment, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated. However, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor or any other party.

13.6 Correction or Removal of Defective Work: If required by Owner, Contractor shall promptly, without cost to Owner and as specified by Owner, either correct any defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Owner, remove it from the site and replace it with nondefective Work.

13.7 One Year Correction Period: If, within one year after the date of Substantial Completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions, either correct such defective Work, or, if it has been rejected by Owner, remove it from the site and replace it with nondefective Work. If Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by Contractor.

13.8 Acceptance of Defective Work:

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so. In such case, if acceptance occurs prior to Owner's recommendation of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Prices or, if the acceptance occurs after such recommendation, an appropriate amount shall be paid by Contractor to Owner.

B. Owner may require Contractor to furnish, at Contractor's expense, performance guarantees and additional Bonds prior to acceptance of defective Work.

13.9 Owner May Correct Defective Work: If Contractor fails within a reasonable time after written notice of Owner to proceed to correct and to correct defective work or to remove and replace rejected Work as required by Owner in accordance with Paragraph 13.6, or if Contractor fails to perform the work in accordance with the Contract Documents (including any requirements of the progress schedule), Owner may, after seven days' written notice to Contractor, correct and remedy any such deficiency. In exercising his rights under this Paragraph, Owner shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees such access to the site as may be necessary to enable Owner to exercise his rights under this Paragraph. All direct and indirect costs of Owner in exercising such rights shall be charged against Contractor in an amount verified by Owner, and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents and a reduction in the Contract Price. Such direct

and indirect costs shall include, in particular but without limitation, compensation for additional professional services required and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Time because of any delay in his performance of the Work attributable to the exercise by Owner of Owner's rights hereunder

ARTICLE 14 — PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Schedules: At least twenty days prior to submitting the first application for a progress payment, Contractor shall (except as otherwise specified in the General Requirements) submit to Owner a progress schedule, final schedule of Shop Drawings submission and where applicable, a schedule of values of the Work. These schedules shall be satisfactory in form and substance to Owner. The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon acceptance of the schedule of values by Owner, it shall be incorporated into a form of Application for Payment acceptable to Owner.

14.2 Monthly Estimates and Partial Payments: The Contractor's partial payment period shall end on the last day of each month. The Contractor shall submit acceptable Application for Payment to the Owner by the 5th of each month provided that the amount due on completed work is at least $500.00. The partial payment request shall be filled out and signed by the Contractor covering the work completed as of the date of the request and accompanied by such supporting documentation as is required by the Contract Documents and also as the Owner may reasonably require. The Owner may include in any monthly estimate advances covering approximately 95 percent of the value of unused materials delivered and stored on the site of the work. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site, the Application for Payment shall also be accompanied by such data, satisfactory to Owner, as will establish Owner's title to the material and equipment and protect Owner's title to the material and equipment and protect Owner's interest therein, including applicable insurance. Each subsequent Application for Payment shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied to discharge in full all of Contractor's obligations reflected in prior Applications for Payment.

After each monthly estimate has been approved, the Owner shall pay to the Contractor 95 percent of the amount of said estimate. From the total value of each estimate there will be deducted an amount equivalent to 5 percent of the whole as a retainage to be held by the Owner. The monthly estimates will be approximate only and subject to correction in any subsequent estimate rendered following discovery of the error. The Owner may include any monthly advances covering approximately 95 percent of the value of unused materials delivered and stored on the site of the work.

Subsequent to discovery of any defective or questionable work, an amount equal to the estimated value of such work will be deducted from the next current estimate. The sum will not be included in a subsequent estimate until the defects have been remedied to the Owner's satisfaction.

The Owner reserves the right to withhold payment of any monthly estimate that becomes due if, in the opinion of the Owner's Attorney, such action is warranted because of any breach of the Contract Provisions or malfeasance on the part of the Contractor or because the progress or the quality of the work is unsatisfactory and does not comply with the Plans and Specifications.

The Contractor may, at his option, withdraw the 5 percent retainage, or a part thereof, after 50 percent of the work has been completed, provided the Contractor has placed negotiable securities with the Owner in compliance with Section 8-29-3(f)(g)(i) of the Alabama Code of Law

14.3 Contractor's Warranty of Title: Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

14.4 Review of Applications for Progress Payments:

A. Owner will, within ten days after receipt of each Application for Payment, either indicate in writing his recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Owner's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

B. Any payment requested in an Application for Payment will constitute a representation, based on Owner's on-site observations of the Work in progress as an experienced and qualified design professional and on Owner's review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated that, to the best of Owner's knowledge, information and belief, the quality of the work is in accordance with the Contract Documents (subject to an evaluation of the work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in the recommendation) and that Contractor is entitled to payment of the amount recommended. However, by recommending any such payment Owner will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work, or that the means, methods, techniques, sequences, and procedures of construction have been reviewed, or that any examination has been made to ascertain how or for what purpose Contractor has used the moneys paid or to be paid to Contractor on account of the Contract Price, or that title to any Work, materials or equipment has passed to Owner free and clear of any Liens.

C. Recommendation of final payment will constitute an additional representation to Owner that the conditions precedent to Contractor's being entitled to final payment as set forth in Paragraph 14.9 have been fulfilled.

D. Owner may refuse to recommend the whole or any part of any payment if it would be incorrect to make such representations. Owner may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary to protect Owner from loss because:

1. The Work is defective, or completed Work has been damaged requiring correction or replacement,
2. Written claims have been made against Owner or Liens have been filed in connection with the Work,
3. The Contract Price has been reduced because of Modifications,

4. Owner has been required to correct defective Work or complete the Work in accordance with Paragraph 13.9,
5. Of Contractor's unsatisfactory prosecution of the Work in accordance with the Contract Documents, or
6. Of Contractor's failure to make payment to Subcontractors for labor, materials or equipment.

14.5 Substantial Completion:

A. When Contractor considers the entire Work ready for its intended use, Contractor shall, in writing to Owner, certify that the entire Work is substantially complete and request that Owner issue a certificate of Substantial Completion. Within a reasonable time thereafter, Contractor and Owner shall make an inspection of the Work to determine the status of completion. If Owner does not consider the Work substantially complete, Owner will notify Contractor in writing giving his reasons therefore. If Owner considers the Work substantially complete, Owner will prepare and deliver a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Contractor shall have seven days after receipt of the tentative certificate during which Contractor may make written objection to Owner as to any provisions of the certificate or attached list. If, after considering such objections, Owner concludes that the Work is not substantially complete, Owner will within fourteen days after submission of the tentative certificate to Owner notify Contractor in writing, stating his reasons therefore. If, after consideration of Contractor's objections, Owner considers the Work substantially complete, Owner will within said fourteen days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Owner believes justified after consideration of any objections from Contractor. At the time of delivery of the tentative certificate of Substantial Completion Owner will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, heat, utilities and insurance. Unless Owner and Contractor agree otherwise in writing and so inform Owner prior to his issuing the definitive certificate of Substantial Completion Owner's aforesaid recommendation will be binding on Owner and Contractor until final payment.

B. Owner shall have the right to exclude Contractor from the Work after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items in the tentative list.

14.6 Partial Utilization: Use by Owner of completed portions of the Work may be accomplished prior to Substantial Completion of all the Work subject to the following:

A. Owner at any time may request Contractor in writing to permit Owner to use any part of the Work which Owner believes to be substantially complete and which may be used without significant interference with construction of the other parts of the Work. If Contractor agrees, Contractor will certify to Owner that said part of the Work is substantially complete and request Owner to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time thereafter Owner, Contractor and Owner shall make an inspection of that part of the Work to determine its status of completion. If Owner does not consider that part of the Work to be substantially

complete, Owner will notify Contractor in writing giving his reason therefore. If Owner considers that part of the Work to be substantially complete, Owner will execute and deliver to Owner and Contractor a certificate to that effect, fixing the date of Substantial Completion as to that part of the Work, attaching thereto a tentative list of items to be completed or corrected before final payment. Prior to issuing a certificate of Substantial Completion as to part of the Work, Owner will deliver to Contractor a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor, with respect to security, operation, safety, maintenance, utilities and insurance for that part of the Work which shall become binding upon Owner and Contractor at the time of issuing the definitive certificate of Substantial Completion as to that part of the Work, unless Owner and Contractor shall have otherwise agreed in writing and so informed Owner. Owner shall have the right to exclude Contractor from any part of the Work which Owner has so certified to be substantially complete, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

B. In lieu of the issuance of a Certificate of Substantial Completion as to part of the Work, Owner may take over operation of a facility constituting part of the Work whether or not it is substantially complete if such facility is functionally and separately useable provided that prior to any such take over, Owner and Contractor have agreed as to the division of responsibilities between Owner and Contractor for security, operation, safety, maintenance, correction period, heat, utilities and insurance with respect to such facility.

C. No occupancy of part of the Work or taking over of operations of a facility will be accomplished prior to compliance with the requirements of Paragraph 5.8, in respect of property insurance.

14.7 Final Inspection: Upon written notice from Contractor that the Work is complete, Owner will make a final inspection with Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to remedy such deficiencies.

14.8 Final Application for Payment: After Contractor has completed all such corrections to the satisfaction of Owner and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked up record documents, and other documents--all as required by the Contract Documents, and after Owner has indicated that the Work is acceptable (subject to the provisions of Paragraph 14.10) Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents and such other data and schedules as Owner may reasonably require, together with complete and legally effective releases or waivers (satisfactory to Owner) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by Owner, Contractor may furnish receipts or releases in full as an affidavit of Contractor that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or his property might in any way be responsible, have been paid or otherwise satisfied and consent of the Surety, if any, to final payment. If any Subcontractor, manufacturer, fabricator, supplier or distributor fails to furnish a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

14.9 Final Payment and Acceptance:

A. If, on the basis of Owner's observation of the Work during construction and final inspection and Owner's review of the final Application for Payment and accompanying documentation -- all as required by the Contract Documents, Owner is satisfied that the Work has been completed and Contractor has fulfilled all of his obligations under the Contract Documents, Owner will, within ten days after receipt of the final Application for Payment, indicate in writing his recommendation of payment and present the Application to Owner for payment. Thereupon Owner will give written notice to Contractor that the Work is acceptable subject to the provisions of Paragraph 14.11. Otherwise, Owner will return the Application to Contractor indicating in writing the reasons for refusing to recommend final payment in which case Contractor shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, Owner shall, within thirty days after receipt thereof, pay Contractor the amount recommended.

B. If, through no fault of Contractor, final completion is materially delayed, Owner shall, upon receipt of Contractor's final Application for Payment and recommendation of Owner, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in Paragraph 5.1, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Owner with his Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

14.10 Contractor's Continuing Obligation: Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by Owner, nor the issuance of a certificate of Substantial Completion, nor any payment by Owner to Contractor under the Contract Documents, nor any use or occupancy of the Work or any part thereof by Owner, nor any act of acceptance by Owner nor any failure to do so, nor the issuance of a notice of acceptability by Owner pursuant to Paragraph 14.9, nor any correction of defective Work by Owner shall constitute an acceptance of Work not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents.

14.11 Waiver of Claims: The making and acceptance of final payment shall constitute:

A. A waiver of all claims by Owner against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.7 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein: however it shall not constitute a waiver by the Owner of any rights in respect of Contractor's continuing obligations under the Contract Documents; and

B. A waiver of all claims by Contractor against Owner other than those previously made in writing and still unsettled.

ARTICLE 15 — SUSPENSION OF WORK AND TERMINATION

15.1 Owner May Suspend Work: Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to Contractor and Owner which shall fix the date on which Work shall be resumed. Contractor shall resume the Work on the date so fixed. Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if he makes a claim therefore as provided in Articles 11 and 12.

15.2 Owner May Terminate:

A. Upon the occurrence of any one or more of the following events:

1. If Contractor is adjudged as bankrupt or insolvent,
2. If Contractor makes a general assignment for the benefit of creditors,
3. If a trustee or receiver is appointed for Contractor or for any of Contractor's property,
4. If Contractor files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or similar laws,
5. If Contractor repeatedly fails to supply sufficient skilled Workmen or suitable materials or equipment,
6. If Contractor repeatedly fails to make prompt payments to Subcontractors or for labor, materials or equipment,
7. If Contractor disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction,
8. If Contractor disregards the authority of Owner, or
9. If Contractor otherwise violates in any substantial way any provisions of the Contract Documents,

Owner may after giving Contractor and his Surety seven days' written notice, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Work, including compensation for additional professional services, such excess shall be paid to Contractor. If such costs exceed such unpaid balance, Contractor shall pay the difference to Owner. Such costs incurred by Owner shall be verified by Owner and incorporated in a Change Order, but in finishing the work Owner shall not be required to obtain the lowest figure for the Work performed.

15.3 Where Contractor's services have been so terminated by Owner, the termination shall not affect any rights of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.4 Upon seven days' written notice to Contractor and Owner, Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, Contractor shall be paid for all Work executed and any expense sustained plus

reasonable termination expenses.

15.5 Contractor May Stop Work or Terminate: If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety days by Owner or under an order of court or other public authority, or Owner fails to acts on any Application for Payment within thirty days after it is submitted, or Owner fails to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days' written notice to Owner, terminate the Agreement and recover from Owner payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu if terminating the Agreement, if Owner has failed to act on an Application for Payment or Owner has failed to make any payment as aforesaid, Contractor may upon seven days' written notice to Owner stop the Work until payment of all amounts then due. The provision of this paragraph shall not relieve Contractor of his obligations under Paragraph 6.14 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with Owner.

ARTICLE 16 — DISPUTE RESOLUTION

16.1 Unless otherwise provided in the Supplementary Conditions, all claims, disputes and other matters in question between Owner and Contractor arising out of, or relating to the Contract Documents or the breach thereof, except for claims which have been waived by the making or acceptance of final payment as provided by Paragraph 14.11, shall be decided by the courts of the jurisdiction in which the Project is located.

16.2 In the case of any dispute that is required to be referred to Owner initially for decision in accordance with Paragraph 9.6, no legal proceeding shall be instituted prior to the earlier of (a) the date on which Owner has rendered a decision, or (b) the tenth day after the parties have presented their evidence to Owner; and no proceeding with respect to such dispute shall be made later than thirty days after the date on which Owner has rendered a written decision in respect thereof.

ARTICLE 17 — MISCELLANEOUS

17.1 Giving Notice: Whenever any provision of the Contract Documents requires the giving of written notice it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of notice.

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

17.3 General:

A. Should Owner suffer injury or damage to his person or property because of any error, omission or act of the Contractor or of any of the Contractor’s employees or agents or others for whose acts the Contractor is legally liable, claim shall be made in writing to the Contractor within a reasonable time of the first observance of such injury or damage.

B. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor, by Paragraphs 6.15, 13.1, 13.6, 13.9, 14.3 and 15.2 and all of the rights and remedies

available to Owner thereunder, shall be in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by law or contract, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this Paragraph shall be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents shall survive final payment and termination or completion of this Agreement.

17.4 Headings: The Article and Paragraph headings are inserted for convenience only and do not constitute part of these General Conditions.

END OF SECTION

State of Alabama
Alabama Department of Environmental Management
State Revolving Fund (SRF) Loan Program

SRF Section
Permits and Services Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

(334) 271-7793
(334) 271-7950 FAX

Supplemental General Conditions

for SRF Assisted

Public Drinking Water and Wastewater
Facilities Construction Contracts

Clean Water
State Revolving Fund

Protect Our Health from Source to Tap
Drinking Water State Revolving Fund

SRF Project Number: _____

Table of Contents:

I – ADEM Special Conditions

1. Construction within State right-of-way shall be in accordance with Alabama Department of Transportation policies and procedures.

2. Construction is to be carried out in compliance with applicable NPDES permits and in a manner that prevents bypassing of raw wastewater flows during construction. If bypassing is anticipated, the ADEM NPDES Enforcement Branch (334-271-7975) shall be advised in advance and the contractor shall take all necessary steps to minimize the impacts of bypassing.

3. Siltation and soil erosion shall be minimized during construction. The contractor shall obtain an NPDES storm water permit for construction if required.

4. The owner shall provide and maintain competent and adequate supervision and inspection.

5. ADEM and EPA shall have access to the site and the project work at all times.

6. These Special Conditions shall supersede any conflicting provisions of this contract.

7. A project sign is required. See **Parts XVII and XVIII, pages SGC-34 – SGC-35**, for more information.

II – Bonds and Insurance

Bonding requirements shall comply with Alabama Act No. 97-225. Provisions of the Act are summarized below:

1. Bid Bond – Not less than 5% of either the owner's estimated cost or of the contractor's bid up to a maximum $10,000. The bid guarantee shall consist of a cashier's check drawn on an Alabama bank or a bid bond executed by a surety company duly authorized and qualified to make bonds in the State of Alabama.

2. Performance Bond – 100% of the contract price.

3. Payment Bond – Payable to the awarding authority, shall be executed in an amount not less than 50% of the contract price.

In addition to the insurance requirements elsewhere in the specifications, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 40 CFR 30.600 (b), if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency.

III – Utilization of Disadvantaged Businesses Enterprises (DBEs)

It is the policy of the State Revolving Loan Fund (SRF) to promote a "fair share" of sub-agreement awards to small, minority, and women-owned businesses for equipment, supplies, construction, and services. Compliance with these contract provisions is required in order for project costs to be eligible for SRF funding. The "fair share" objective is a goal, not a quota.

Failure on the part of the apparent successful bidder to submit required information to the loan recipient (Owner) may be considered by the Owner in evaluating whether the bidder is responsive to bid requirements.

The project objectives for utilization of Minority Business Enterprises (MBE's) and Women's Business Enterprises (WBE's) are as follows:

Commodities (Supplies)	MBE 4%	WBE 11%
Contractual (Services)	MBE 8%	WBE 30%
Equipment	MBE 5%	WBE 20%
Construction	MBE 2.5%	WBE 3%

For purposes of clarification:

- This objective applies to any Federally assisted procurement agreement in excess of $10,000.
- This objective necessitates three responsibilities; separate solicitations must be made of small and minority and women's business enterprises.
- A minority business is a business, at least 51 percent of which is owned and controlled by minority group members (Black; Hispanics; Asian American; American Indian; and, any other designations approved by the Office of Management and Budget).
- A women's business is a business, at least 51 percent of which is owned and controlled by one or more women.
- The control determination will revolve around the minority or woman owner's involvement in the day-to-day management of the business enterprise.
- Solicitation should allow adequate time for price analysis; ADEM recommends that contact be made no later than 15 days before bid opening.
- Efforts taken to comply with this objective must be documented in detail; maintain records of firms contacted, including any negotiation efforts to reach competitive price levels, and awards to the designated firms.
- ADEM recommends that the prime contractor utilize the services of the Minority Business Development Service Centers. These Centers are funded by the U.S. Department of Commerce to provide technical, financial and contracting assistance to minority and women's business enterprises. These Centers are located in a number of Regional cities.
- Use of the services provided by Centers does not absolve the prime contractors from pursuing additional efforts to meet this objective.

IV – Six Affirmative Steps for Good Faith DBE Solicitation

The loan recipient shall follow the six affirmative steps found in the SRF application when using loan funds to procure sources of supplies, construction and services.

If the successful bidder plans to subcontract a portion of the project, the bidder must submit to the owner within 10 days after bid opening, evidence of the affirmative steps taken to utilize small, minority and women's businesses. These six affirmative steps or ‘good faith efforts’ are required methods to ensure that DBEs have the opportunity to compete for procurements funded by EPA financial assistance dollars. Such affirmative steps are described as follows:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. This will include placing DBEs on solicitation lists and soliciting them whenever there are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the resources, services, and assistance of the Department of Transportation (DOT), Small Business Administration (SBA), and the Minority Business Development Agency of the Department of Commerce (MBDA).

6. If the Contractor awards subcontracts, it must take the steps described in items (1) through (5) listed above.

V – Documentation Required from Owner and Contractor

The low, responsive, responsible bidder must forward the following items, in duplicate, to the Owner no later than 10 days after bid opening. The Owner shall transmit one (1) copy of its DBE documentation of the prime contractor solicitation and the bidder's DBE documentation of all subcontractor solicitation to ADEM within 14 days after bid opening.

1. SRF project number and project name.

2. List of subcontractors (name, address and telephone) with dollar amount and duration for subcontracts). If there are to be no subcontractors, please indicate as such.

3. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

4. DBE Documents - See **Part IV, page SGC-3**.

5. Debarred Firms Certification – See **Part XIV, page SGC-23**.

6. Certification Regarding Equal Employment Opportunity – See **Part XIII, page SGC-22.**

The Owner shall submit annual MBE/WBE Utilization Reports (EPA Form 5700-52A, **pages SGC-16 - SGC-17**) within 30 days of the end of the annual reporting period **(October 30th)**. Submit reports directly to:

Diane Lockwood
Administrative Section
Fiscal Branch
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

The Prime Contractor must submit the following items to the Owner:

1) DBE Compliance Form. The Owner must submit this information to ADEM to demonstrate compliance with the DBE requirements. ADEM's approval is required prior to award of the construction contract and commencement of any SRF-funded construction. (**Page SGC-8**)

2) Certification Regarding Equal Employment Opportunity. This form is required for the prime contractor and for all subcontractors. The prime contractor's form should be submitted with the DBE Compliance Form and the subcontractors' forms should be submitted as the subcontracts are executed. (**Page SGC-22**)

3) Debarred Firms Certification. This form is required for the prime contractor and for all subcontractors. The prime contractor's form should be submitted with the DBE Compliance Form and the subcontractors' forms should be submitted as the subcontracts are executed. (**Page SGC-23**)

4) EPA Form 6100-2 DBE Subcontractor Participation Form. This form gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the prime contractor, how much the DBE subcontractor was paid, and any other concerns the DBE subcontractor might have. The prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to ADEM's DBE Coordinator (to be forwarded to EPA's DBE Coordinator). (**Page SGC-10**)

5) EPA Form 6100-3 DBE Subcontractor Performance Form. This form captures an intended DBE subcontractor's description of work to be performed for the prime contractor and the price of the work. This form is to be provided by the prime contractor to each DBE subcontractor and submitted with the DBE Compliance Form. (**Page SGC-12**)

6) EPA Form 6100-4 DBE Subcontractor Utilization Form. This form captures the prime contractor's intended use of an identified DBE subcontractor and the estimated dollar amount of the work. This form is to be completed by the prime contractor and submitted with the DBE Compliance Form. (**Page SGC-14**)

7) EPA Form 5700-52 A MBE/WBE Utilization Reports (DBE Annual Report). The Owner must submit this information to ADEM within 30 days of the end of the annual reporting period **(October 30th)**. (**Pages SGC-16 - SGC-17**)

8) Changes to Approved DBE Compliance Form. If any changes, substitutions, or additions are proposed to the subcontractors included in previous Department approvals, the Owner must submit this information to the Department for prior approval in order for the affected subcontract work to be eligible for SRF funding. (**Page SGC-21**)

9) Certified Payrolls. These should be submitted to the Owner at least monthly for the prime contractor and all subcontractors. The Owner must maintain payroll records and make these available for inspection.

Please note that DBEs, MBEs, and WBEs must be certified by EPA, SBA, or DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's). DBEs must be certified in order to be counted toward the recipient's MBE/WBE accomplishments. Depending upon the certifying agency, a DBE may be classified as a DBE, a Minority Business Enterprise (MBE), or a Women's Business Enterprise (WBE).

The documentation of these good faith solicitation efforts must be detailed in order to allow for satisfactory review. Such documentation might include fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with at least 1 logged phone call.

The prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the prime contractor has achieved its fair share objectives

The prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the prime contractor has achieved its fair share objectives. If a DBE subcontractor fails to complete work under the subcontract for any reason, the prime contractor must notify the Owner in writing prior to any termination and must employ the six good faith efforts described above if using a replacement subcontractor. Any proposed changes from an approved DBE subcontractor must be reported to the Owner and to ADEM on the Changes to Approved Subcontractors Form prior to initiation of the action. EPA Forms Nos. 6100-3 and 6100-4 must also be submitted to ADEM for new DBE subcontracts.

VI – Resources for Identifying DBE Contractors/Subcontractors

The following organizations may provide assistance in soliciting DBE participation:

City of Birmingham
Office of Economic Development
ATTN: Monique Shorts, Economic Specialist
710 20th Street North
Birmingham, Alabama 35203
205/254-2799
205/254-7741 FAX
Monique.shorts@birminghamal.gov

U.S. Small Business Administration
http://www.pro-net.sba.gov

National Association of Minority Contractors (NAMC)
http://www.namc-atl.org

Alabama Department of Transportation
ATTN: John Huffman
1409 Coliseum Boulevard
Montgomery, Alabama 36130
334-244-6261
http://www.dot.state.al.us

U.S. Department of Commerce
Minority Business Development Agency
ATTN: Donna Ennis
75 5th Street NW-
Suite 300
Atlanta, Georgia 30308
404/894-2096
http://www.mbda.gov/

Governor's Office of Minority and Women's Business Enterprises
Ms. Hilda Lockhart
STEP Project Director
401 Adams Avenue
Suite 360
Montgomery, Alabama 36130
334/242-2220

Birmingham Construction Industrial Authority
ATTN: Ashley Orl or Kimberly Bivins
601 37th Street South
Birmingham, Alabama 35222
205/324-6202
aorl@bcia1.org
kbaylorbivins@bcia1.org

NOTES:

(1) The Owner and the prime contractor shall use the necessary resources to identify and directly solicit no less than 3 certified DBE/MBE firms and 3 WBE firms to bid in each expected contract/subcontract area. If a diligent and documented search of ALDOT, SBA, and MBDA directories does not identify 3 potential certified DBE/MBE firms and 3 potential certified WBE firms, then the prime contractor shall post an advertisement in at least 1 of the other online or print resources. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

(2) Expenditures to a DBE that acts merely as a broker or passive conduit of funds, without performing, managing, or supervising the work of its subcontract in a manner consistent with normal business practices may not be counted.

(3) The prime contractor should attempt to identify and first solicit DBEs in the geographic proximity of the project before soliciting those located farther away.

(4) In addition, you may contact ADEM's DBE Coordinator, Diane Lockwood, at (334) 271-7815 for assistance.

VII – DBE Compliance Form

PLEASE NOTE: ALL INFORMATION OUTLINED ON THIS FORM IS REQUIRED FOR DBE COMPLIANCE. THE PROPOSED PRIME CONTRACTOR AND OWNER SHOULD ENSURE THAT THIS INFORMATION IS COMPLETE PRIOR TO SUBMITTAL.

Loan Recipient: _____ SRF Loan Number: _____

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this firm has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants and that EPA Forms 6100-2 and 6100-3 were distributed to all DBE subcontractors.

_____ Date_____
(Prime Contractor signature)

_____
(Printed name and title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Owner's State Revolving Fund loan contract.

_____ Date_____
(Signature of Owner or Owner's representative)

_____
(Printed name and title)

GENERAL INFORMATION:

Owner contact: _____

Owner phone number/email:
_____

Consulting engineer contact:
_____

Consulting engineer phone number/email:
_____

Proposed prime contractor:
_____

Prime contractor contact:
_____

Prime contractor phone number/email:
_____

Proposed prime contract amount: $ _____

Proposed total DBE/MBE participation: $ _____ Percentage: ____% Goal: 2.5%

Proposed total WBE participation: $ _____ Percentage: ____% Goal: 3.0%

Please submit the following with the DBE COMPLIANCE FORM:

(1) List of all committed and uncommitted subcontractors by trade, including company name, address, telephone number, contact person, dollar amount of subcontract, and DBE/MBE/WBE status. Indicate in writing if no solicitations were made because the contractor intends to use only its own forces to accomplish the work.

(2) Proof of certification by EPA, SBA, DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE, or WBE.

(3) Documentation of solicitation effort for prospective DBE firms, such as fax confirmation sheets, copies of solicitation letters/emails, printout of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with at least 1 logged phone call. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

(4) Justification for not selecting a certified DBE subcontractor that submitted a low bid for any subcontract area.

(5) Certification By Proposed Prime Contractor or Subcontractor Regarding Equal Employment Opportunity. (**Page SGC-22**)

(6) Debarred Firms Certification. (**Page SGC-23**)

(7) EPA Form 6100-3 DBE Subcontractor Performance Form for all DBE subcontracts. (**Page SGC-12**)

(8) EPA Form 6100-4 DBE Subcontractor Utilization Form for all DBE subcontracts. (**Page SGC-14**)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/ 13/ 2013
Approval Expires: 8/ 31/ 2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: O DOT O SBA O Other: _____		Meets/ exceeds EPA certification standards? O YES O NO O Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	○ YES	⊙ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

OMB CONTROL NO. 2090-0030
APPROVED: 05/01/2008
APPROVAL EXPIRES: 12/22/2013

U.S. ENVIRONMENTAL PROTECTION AGENCY
MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

PART I. (Reports are required even if no procurements are made during the reporting period.)

1A. FEDERAL FISCAL YEAR (Oct. 1-Sep 30) 20_____	1B. REPORTING PERIOD (Check ALL appropriate boxes) ☐ 1st (Oct-Dec) ☐ 2nd (Jan-Mar) ☐ 3rd (Apr-Jun) ☐ 4th (Jul-Sep) ☐ Semi-Annual (Oct-Mar) ☐ Semi-Annual (Apr-Sep) ☐ Annual ☐ Check if this is the last report for the project (Project completed).
1C. REVISION OF A PRIOR REPORT? Y or N Year: _____ Quarter: _____	BRIEFLY DESCRIBE THE REVISIONS YOU ARE MAKING:

2A. EPA FINANCIAL ASSISTANCE OFFICE ADDRESS (ATTN: DBE Coordinator)		3A. RECIPIENT NAME AND ADDRESS	
2B. EPA DBE COORDINATOR Name: E-mail:	2C. PHONE: Fax:	3B. RECIPIENT REPORTING CONTACT: Name: E-mail:	3C. PHONE: Fax:
4A. FINANCIAL ASSISTANCE AGREEMENT ID NUMBER (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.)		4B. FEDERAL FINANCIAL ASSISTANCE PROGRAM TITLE or CFDA NUMBER:	

5A. TOTAL ASSISTANCE AGREEMENT AMOUNT (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.) EPA Share: $_____ Recipient Share: $_____	5B. If NO procurement and NO accomplishments were made this reporting period (by the recipients, sub-recipients, loan recipients, and prime contractors), **CHECK** and **SKIP** to Block No. 7. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs. Accomplishments, in this context, are procurements made with MBEs and/or WBEs. ☐

5C. Total Procurements This Reporting Period
(Only include amount not reported in any prior reporting period)

Total Procurement Amount $_____ (Include total dollar values awarded by recipient, sub-recipients and SRF loan recipients, **including MBE/WBE expenditures.)**

5D.
Were sub-awards issued under this assistance agreement? Yes☐ No☐ Were contracts issued under this assistance agreement ? Yes☐ No☐

5E. MBE/WBE Accomplishments This Reporting Period

Actual MBE/WBE Procurement Accomplished:
(Include total dollar values awarded by recipient, sub-recipients, SRF loan recipients and Prime Contractors.)

	Construction	Equipment	Services	Supplies	Total
$MBE:					0.00
$WBE:					0.00

6. COMMENTS: (If no MBE/WBE procurements were accomplished during the reporting period, please explain what steps you are taking to achieve the MBE/WBE Program requirements specified in the terms and conditions of the Assistance Agreement.)

7. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	TITLE
8. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	DATE

EPA FORM 5700-52A available electronically at http://www.epa.gov/osbp/pdfs/5700_52a.pdf

PART II. **MBE/WBE PROCUREMENTS MADE DURING REPORTING PERIOD**
EPA Financial Assistance Agreement Number: _____

1. Procurement Made By			2. Business Enterprise		3. $ Value of Procurement	4. Date of Procurement MM/DD/YY	5. Type of Product or Services[A] (Enter Code)	6. Name/Address/Phone Number of MBE/WBE Contractor or Vendor
Recipient	Sub-Recipient and/or SRF Loan Recipient	Prime	Minority	Women				

Type of product or service codes:

1 = Construction 2 = Supplies 3 = Services 4 = Equipment

Note: Refer to Terms and conditions of your Assistance Agreement to determine the frequency of reporting. Recipients are required to submit MBE/WBE reports to EPA beginning with the Federal fiscal year quarter the recipients receive the award, continuing until the project is completed.

EPA FORM 5700-52A - (Approval Expires 12/22/13)

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. EPA Form 5700-52A must be completed by recipients of Federal grants, cooperative agreements, or other Federal financial assistance which involve procurement of supplies, equipment, construction or services to accomplish Federal assistance programs.

Recipients are required to report 30 days after the end of each federal fiscal quarter, semiannually, or annually, per the terms and conditions of the financial assistance agreement.

	Quarterly Reporting Due Date	Semiannual Reporting Due Date	Annual Reporting Due Date
Agreements awarded prior to May 27, 2008	January 30, April 30, July 30, October 30	N/A	October 30
Agreements awarded on or after May 27, 2008	N/A	April 30, October 30	October 30

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

B. Definitions:

Procurement is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

*A **contract*** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

*A **minority business enterprise*** (MBE) is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

*A **woman business enterprise*** (WBE) is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact managed and operated by non-minority individuals do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

Good Faith Efforts

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Include of MBEs/WBEs on solicitation lists.
2. Assure that MBEs/WBEs are solicited once they are identified.
3. Divide total requirements into smaller tasks to permit maximum MBE/WBE participation, where feasible.
4. Establish delivery schedules which will encourage MBE/WBE participation, where feasible.
5. Encourage use of the services of the U.S. Department of Commerce's Minority Business Development Agency (MBDA) and the U.S. Small Business Administration to identify MBEs/WBEs.

6. Require that each party to a subgrant, subagreement, or contract award take the good faith efforts outlined here.

C. Instructions for Part I:

1a. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th **(e.g. November 29, 2010 falls within Federal fiscal year 2011)**

1b. Check applicable reporting box, quarterly, semiannually, or annually. Also indicate if this is the last report for the project.

1c. Indicate if this is a revision to a previous year, half-year, or quarter, and provide a brief description of the revision you are making.

2a-c. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.

The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at www.epa.gov/osbp. Click on "Regional Contacts" for the name of your coordinator.

3a-c. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.

4a. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients**: In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form. Please note that although the New DBE Rule (which took effect May 27, 2008) revised the reporting frequency requirements from quarterly to semiannually, that change only applies to agreements awarded AFTER the New DBE Rule took effect. Therefore, SRF recipients may either continue to report activity for all Agreements on one form on a quarterly basis until the last award that was made prior to the New DBE Rule has been closed out; OR, the recipient may split the submission of SRF reports into quarterly reports for Agreements awarded prior the New DBE Rule, and semiannually for the awards made after the New DBE Rule.

4b. Refer back to Assistance Agreement document for this information.

5a. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: SRF recipients will not enter an amount in 5a. Please leave 5a blank.

5b. Self-explanatory.

5c. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

***NOTE**: To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.

5d. State whether or not sub-awards and/or subcontracts have been issued under the assistance agreement by indicating "yes" or "no".

5e. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: In 5c please enter the total procurement amount for the quarter, or semiannual period, under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

6. If there were no MBE/WBE accomplishments this reporting period, please briefly explain what

specific steps you are taking to achieve the MBE/WBE requirements specified in the terms and conditions of the Assistance Agreement.

7. Name and title of official administrator or designated reporting official.

8. Signature, month, day, and year report submitted.

D. Instructions for Part II:

For each MBE/WBE procurement made under this assistance agreement during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.

2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the "Value of the Procurement" reported in column #3**

3. Dollar value of procurement.

4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**

5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc).

6. Name, address, and telephone number of MBE/WBE firm.

**This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Part 30, 31, and 33); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average I hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.

XII - Changes to Approved DBE Compliance Form

Loan Recipient: _____ SRF Loan Number: _____

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this firm has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants.

_____ Date_____
(Prime Contractor signature)

_____
(Printed name and title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Owner's State Revolving Fund loan contract.

_____ Date_____
(Signature of Owner or Owner's representative)

_____
(Printed name and title)

GENERAL INFORMATION:

(1) If an approved subcontractor is terminated or replaced, please identify this company and briefly state reason.

(2) For new or additional subcontractors, list name, trade, address, telephone number, contact person, dollar amount of subcontract, and DBE status.

(3) Attach proof of certification by EPA, SBA, DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE, or WBE.

(4) Attach documentation of solicitation effort for prospective DBE firms, such as fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each solicitation with at least 1 logged phone call. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

(5) Provide justification for not selecting a certified DBE subcontractor that submitted a low bid for any subcontract area.

XIII – Certification Regarding Equal Employment Opportunity

The contractor is required to comply with Executive Order 112-46 of September 24, 1965 entitled “Equal Employment Opportunity” as amended by Executive Order 11375 of October 13, 1967.

The contract for the work under this proposal will obligate the prime contractor and its subcontractors not to discriminate in employment practices.

The contractor shall not maintain or provide for his/her employees the facilities, which are segregated on a basis of race, creed, color or national origin, whether such facilities are segregated by directive or on a de facto basis.

The contractor must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain his/her eligibility to receive the award of the contract.

The contractor must be prepared to comply in all respects with any contract provisions regarding non-discrimination stipulated in conjunction with labor standards.

CONTRACTOR'S CERTIFICATION:

Contractor's Name: _____

Address: _____

_____

_____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes____ No____
2. Compliance Reports were required to be filed in connection with such contract or subcontract. Yes____ No____
3. Bidder has filed all compliance reports due under applicable contract requirements. Yes____ No____

If answer to item 3 is “No”, please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

Signature of Authorized Official: _____

Title: _____

Date: _____

XIV – Debarred Firms Certification

All prime construction contractors shall certify that Subcontracts have not and will not be awarded to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended and Voluntarily Excluded Persons, in accordance with the provisions of ADEM Administrative Code 335-6-14-.35. Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete this certification in duplicate and submit both copies to the owner with the bid proposal. The owner shall transmit one copy to ADEM within 14 days after the bid opening.

Project Name: _____

SRF Project No.: _____

The undersigned hereby certifies that the firm of _____

_____ has not and will not award a subcontract, in connection with any contract awarded to it as the result of this bid, to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended, and Voluntarily Excluded Persons.

Signature of Authorized Official: _____

Title: _____

Date: _____

XV – Davis-Bacon and Related Acts

Labor Standards Provisions for Federally Assisted Contracts

Wage Rate Requirements Under FY 2013 Continuing Appropriation

I. Requirements under the Consolidated and Further Continuing Appropriations Act. 2013 (P.L. 113-6) For Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Cynthia Y. Edwards at Edwards.Cynthiay@epa.gov or at 404-562-9340 of EPA, Region 4 Grants and SRF Management Section, for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract Subcontract Provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2010 appropriation , the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding.

The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA , the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program.

If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements.

The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages.

In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages.

The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information
indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract . Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/esa/contacts/whd/america2.htm.

"General Decision Number: AL20230103 09/01/2023

Superseded General Decision Number: AL20220103

State: Alabama

Construction Type: Building
BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories)

Counties: Hale and Pickens Counties in Alabama.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be

adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023

SUAL2015-047 08/02/2017

	Rates	Fringes
CARPENTER, Includes Form Work	$ 20.26	8.59
CEMENT MASON/CONCRETE FINISHER, Includes Water Sewer Lines	$ 13.71 **	0.00
ELECTRICIAN	$ 19.98	5.53
LABORER: Common or General, Includes Water Sewer Lines	$ 11.48 **	0.00
LABORER: Pipelayer, Includes Water Sewer Lines	$ 13.91 **	2.04
OPERATOR: Backhoe/Excavator/Trackhoe, Includes Water Sewer Lines	$ 19.31	0.00
OPERATOR: Bulldozer, Includes Water and Sewer Lines	$ 12.00 **	0.00
OPERATOR: Loader, Includes Water Sewer Lines	$ 17.64	2.14
TRUCK DRIVER: Dump Truck, Includes Water Sewer Lines	$ 12.25 **	2.58

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of

the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

XVI – American Iron and Steel Requirement

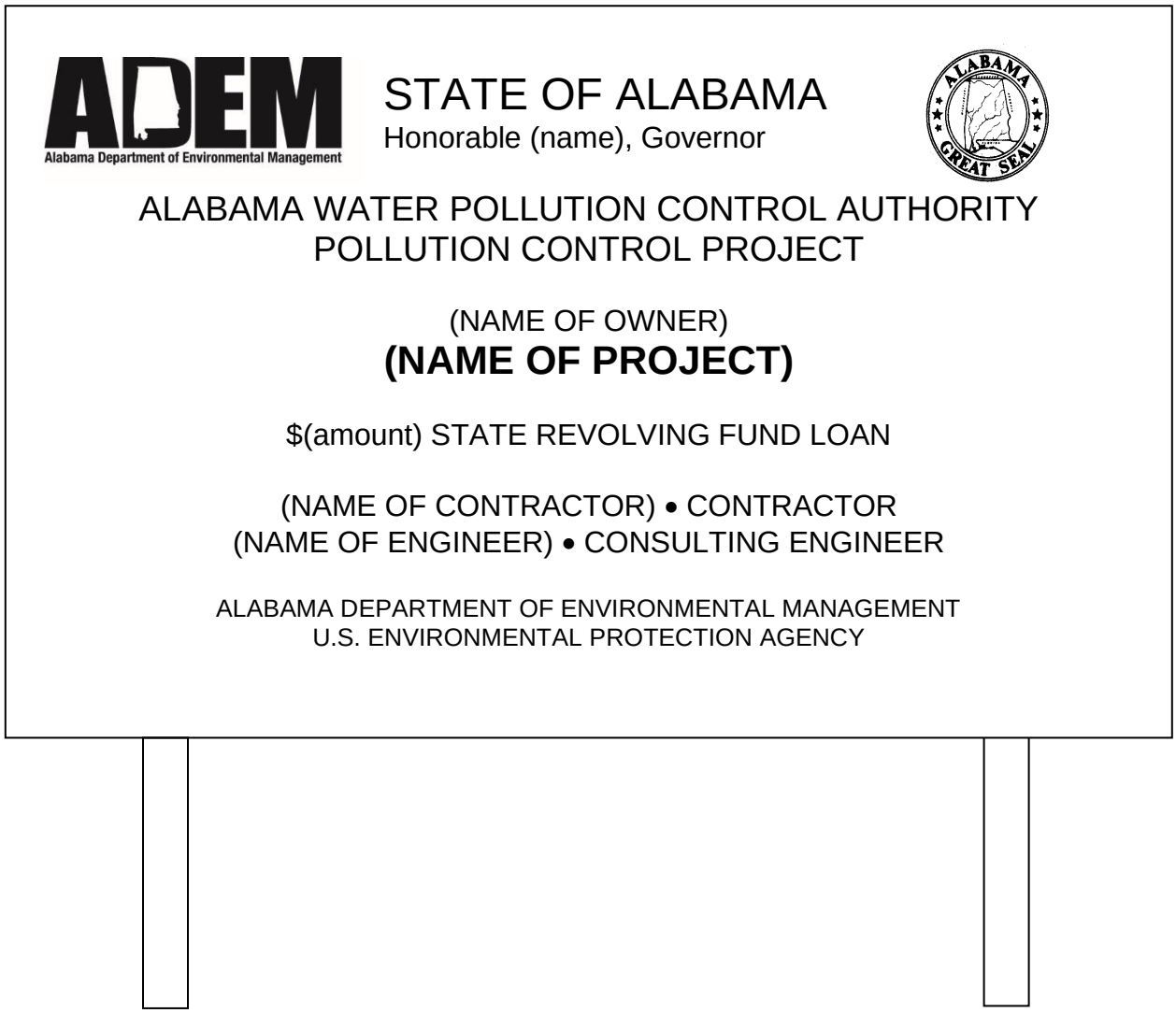
Section 4.13 Compliance with 2014 Appropriations Act. (a) The Loan Recipient agrees to comply with all federal requirements applicable to the Authority Loan (including those imposed by P.L. 113-76, Consolidated Appropriations Act (the "2014 Appropriations Act") and related SRF Policy Guidelines) which the Loan Recipient understands includes, among other things, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel") unless (i) the Loan Recipient has requested and obtained a waiver from the U.S. Environmental Protection Agency pertaining to the Project or (ii) the Authority has otherwise advised the Loan Recipient in writing that the Buy American Requirement is not applicable to the Project. .

(b) The Loan Recipient also agrees to comply with all recordkeeping and reporting requirements under the Clean Water Act (codified generally under 33 U.S.C. §1251 et seq.) (the "Clean Water Act"), including any reports required by a federal agency or the Authority such as performance indicators of program deliverables, information on costs and Project progress. The Loan Recipient understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities, and (ii) failure to comply with the Clean Water Act and this Agreement may be an Event of Default hereunder that results in a repayment of the Authority Loan in advance of the maturity of the Evidence of Indebtedness and/or other remedial actions.

The Loan Recipient agrees to cause all contractors and subcontractors to comply with (through the inclusion of appropriate terms and conditions in all contracts, subcontracts and lower tiered transactions, such terms and conditions to be in substantially the form set forth in connection with the development and construction of the project

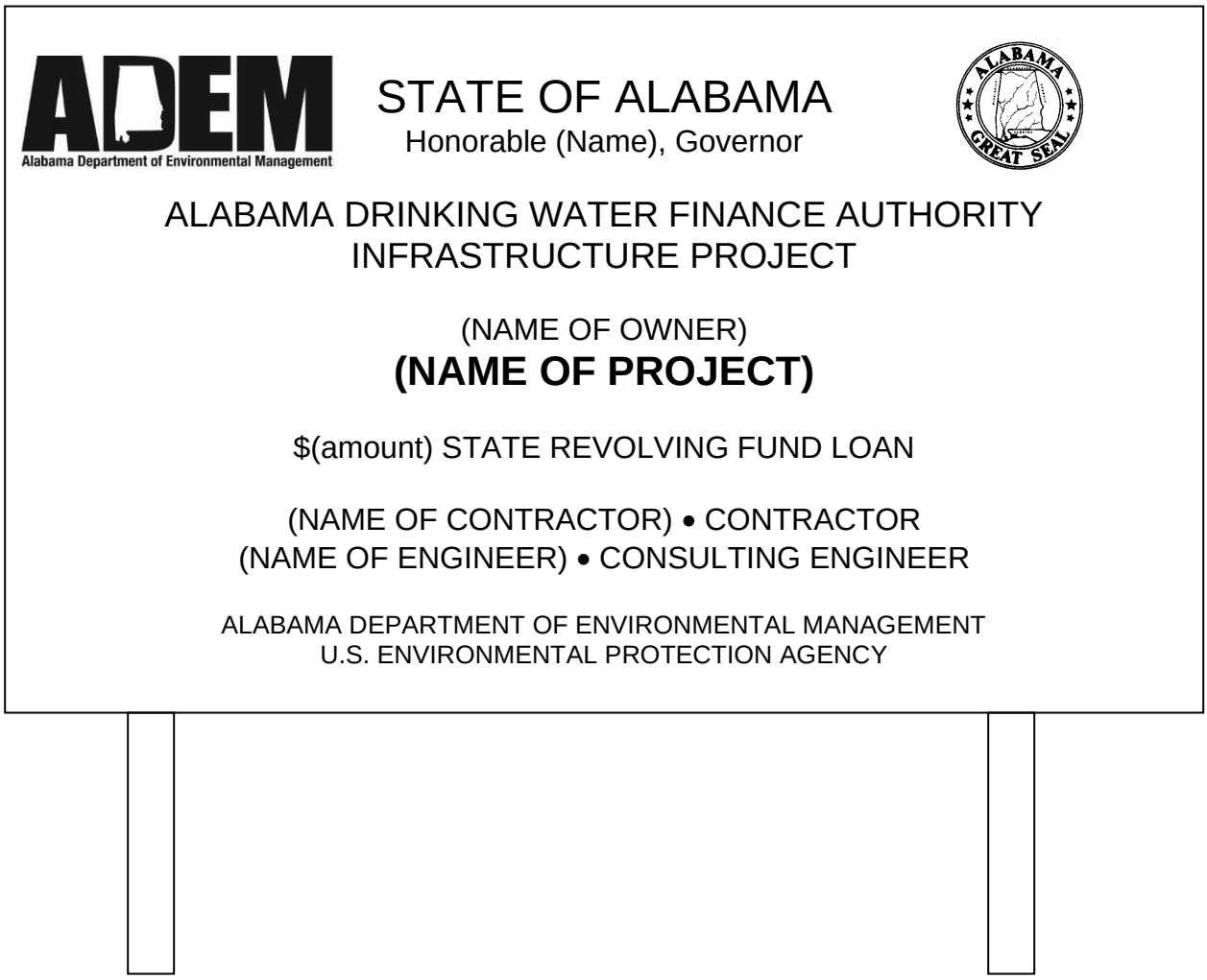
The Contractor acknowledges to and for the benefit of the _____, Alabama ("Purchaser"), and the Alabama Water Pollution Control Authority or the Drinking Water Finance Authority (the "State Authority") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State Authority or any damages owed to the State Authority by the Purchaser). While the Contractor has no direct contractual privity with the State Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State Authority.

XVII – Project Sign Detail - CWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

XVIII – Project Sign Detail - DWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

XIX – Construction Contract Requirements

This checklist is to be completed by the Owner/Engineer when submitting plans and specifications to the SRF and Operator Certification Section for review. It affirms to the SRF reviewer that the Owner/Engineer has addressed these items (in boilerplate form) within the specifications manual.

Contract Page No.	Satisfied Yes/No	
_____	_____	Bid Advertisement (including date, time, and location of bid opening).
_____	_____	Bid Bond.
_____	_____	Performance Bond (100%).
_____	_____	Payment Bond (Not less than 50%).
_____	_____	Contract Length.
_____	_____	Liquidated Damages.
_____	_____	Liability Insurance (including workman's comp, public liability, and builder's risk, if applicable).
_____	_____	Method of Award (i.e. lowest, responsive, responsible bidder).
_____	_____	Air testing of gravity sewers (if applicable).

Within 14 days after bid opening, the Owner/Engineer is to prepare the Project Review and Cost Summary (**page SGC-37**) and submit it to the SRF and Operator Certification Section of ADEM. Upon completion of review, an Approval to Award will be issued.

Note: The Owner assumes all financial risk if the construction contract is awarded prior to the issuance of an Approval to Award by the SRF and Operator Certification Section.

XX – Project Review and Cost Summary

ADEM Alabama Department of Environmental Management	SRF Project Review and Cost Summary	Form Revised 03 -10-10

This form is to be completed and sent with supporting documentation to ADEM within 14 days after bid opening. Following review, an Approval to Award letter will be issued. Upon award of the contract, a complete, bound set of the contract documents should be forwarded to ADEM for review.

Loan Applicant:_____ Project Number:_____

Contract Number/Name:_____

1. Date of plans and specifications concurrence letter from ADEM:_____

   Date of construction permit issuance from ADEM:_____

2. Attach copies of the following documents:

   a. Bid advertisement with certification by publisher and date(s) of publication.

   b. Certified bid tabulation.

   c. Proposal of the selected bidder.

   d. Bid bond.

   e. Engineer's letter to loan applicant recommending award of the contract. If the award is made to other than the low bidder, provide justification.

   f. Site certificates for the project if not previously submitted with SRF loan application.

   g. Documentation from the owner and contractor. The list of required documents can be found in Part III, page SGC-3 of the ADEM Supplemental General Conditions for SRF Assisted Public Drinking Water and Wastewater Facilities Construction Contracts (ADEM FORM 341).

   h. Copy of the wage determination used in bidding.

   i. Any addenda that have been issued after ADEM review of the plans and specifications.

Comments:

SECTION 01010 - SUMMARY OF WORK

PART I — GENERAL

1.01 WORK TO BE DONE

A. The Contractor shall furnish all labor, materials, equipment, tools, services, and incidentals to complete all work required by and in compliance with these Technical Specifications and as shown on the Drawings.

B. The Contractor shall perform the work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements, and restoration required as a result of damages caused during this construction.

C. All materials, equipment, skills, tools, and labor which are reasonably and properly inferable and necessary for the proper completion of the work in a substantial manner and in compliance with the requirements stated or implied by these Technical Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in these Documents or not.

D. The Contractor shall comply with all county, state, federal, and other codes which are applicable to the proposed construction work.

E. Where there are conflicts with underground utilities, the Contractor shall be fully responsible for protecting these facilities and for restoring the portions of those lines that are damaged or severed as a result of the Contractor’s operations. Where existing lines are in conflict, the Contractor shall cooperate with the owner of these utilities to the end that these conflicts may be removed prior to excavation for the work.

F. Structures and pipelines shall be located substantially as indicated on the Drawings, but the Owner reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required. Piping is shown in a schematic manner only and all items of piping may not be shown on the drawings. It is the Contractor's responsibility to furnish all items necessary for a complete and operable system. If additional fittings, pipe, supports, flanges, couplings, concrete or other items are required for a complete and operable system, the Contractor shall furnish and install these items at his expense.

G. All newly constructed work shall be carefully protected from injury in any way. All portions of the work injured shall be reconstructed by the Contractor at his own expense.

1.02 WORK SEQUENCE

A. All work to be done under this contract shall be done with minimum inconvenience to the Public and the existing public utility systems. The Contractor shall coordinate his work with private property owners and local agencies, if required, such that existing service is maintained to all public systems at all times.

B. If required, the Contractor shall construct the Work in stages to accommodate the Owner's use of the premises during the construction period and coordinate the construction schedule and operations with the Owner.

1.03 CONSTRUCTION AREAS

A. The Contractor shall limit his use of the construction areas for work and for storage.

B. The Contractor shall assume full responsibility for the protection, security, and safekeeping of products under this Contract, stored on the site or additional storage areas.

C. The Contractor shall obtain and pay for the use of additional storage or work areas needed for operations.

D. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public (where applicable), Owner's personnel, and workmen. Contractor shall coordinate with governing agencies when working inside or adjacent to road Rights-of-Way.

E. Construction inside or adjacent to Public Rights-of Way:
   1. Contractor must submit a traffic control plan for all Work that will be required within the Right-of-Way of all public roads. Contractor shall receive written permission from the governing local authority prior to beginning any work within these limits.
   2. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, the Contractor shall provide for normal traffic flow during extended construction stoppage, regardless of the cause.
   3. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic safety hazards, the Contractor shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other measures for safety satisfactory to the Owner.
   4. Detours around construction areas will be subject to the approval of the Owner. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations.

1.04 PLANS AND SPECIFICATIONS

A. Specifications: The Technical Specifications consist of three parts: General, Products, and Execution. The General section contains general requirements which govern the work. The Products and Execution sections modify and supplement these by detailed requirements of the work and shall always govern whenever there appears to be a conflict.

B. Intent

1. All work called for in the Technical Specifications applicable to the Contract but not shown on the Plans in their present form or vice versa shall be of like effect as if shown or mentioned in both. Work not specified in either the plans or in the Technical Specifications but involved in carrying out their intent or in the complete and proper execution of the work is required and shall be performed by the Contractor as though it were specifically delineated or described at the Contractor's expense.

2. The apparent silence of the Technical Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Technical Specifications shall be made upon that basis.

1.05 SPECIAL PROJECT PROCEDURES

A. Provisions for Control of Erosion and Pollutants: Sufficient precautions shall be taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other materials harmful to humans, fish, or other life, into the ground and surface waters of the state. Control measures shall be adequate to assure that turbidity in the receiving waters will not be increased more than otherwise required by the state or other controlling agency. Special precautions shall be taken in the use of construction equipment to prevent operations which promote erosion. The Contractor shall be responsible for obtaining all permits in conjunction with the conveyance of storm water during construction activities.

B. In the event of inclement weather, the Contractor and subcontractors will protect carefully the work and materials against damage or injury from the weather. Damaged work and materials shall be removed and replaced. If, in the opinion of the Owner, any portion of work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or subcontractors to so protect the work, no additional time for removal and replacement will be given by the Owner.

C. Public Nuisance:

1. The Contractor shall not create a public nuisance, including but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

2. No extra payment will be made for time lost due to work stoppage resulting from the creation of a public nuisance.

D. Relocations: The Contractor shall be responsible for the relocation of structures, including but not limited to, light poles, signs, sign poles, fences, piping, conduits, and drains that interfere with the positioning of the work. The cost of all such relocations shall be absorbed in the cost of the project at no additional cost to the Owner. **THIS REQUIREMENT DOES NOT APPLY TO AREAS IDENTIFIED AS DRY BORE**.

E. Permits: Prior to beginning Work, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Owner. The cost for obtaining all permits shall be borne by the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01026 – MOBILIZATION – DEMOBILIZATION

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. This section covers mobilization, demobilization, office overhead, job trailer, temporary facilities, bonds, insurance, permits, and other fixed costs associated with the execution of the work.

1.02 MAXIMUM ACCEPTABLE VALUE:

A. The value for this Bid Item shall not exceed seven percent (7%) of the Total Base Bid Price. Any fixed cost in excess of this value shall be incidental to the various unit price items of the work.

1.03 RELATED DOCUMENTS:

A. The Contract Documents, including the General Conditions, Special Conditions, Division 1 Specifications, Technical Specifications, and the Contract Drawings are related to this Specification Section.

1.04 MEASUREMENT AND PAYMENT:

A. 25% of the Lump Sum Bid Unit Price for Mobilization and Demobilization shall be included as work complete on the first application for payment after the Contractor occupies the site, moves in equipment for the execution of the work and begins the work.

B. The remaining 75% shall be prorated based on the work complete on each subsequent application for payment.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01060 - REGULATORY AND SAFETY EQUIPMENT

1.01 GENERAL:

A. The Contractor shall maintain all work areas within or outside the project boundaries free of environmental pollution, abide by all applicable regulations set forth by Federal, State and Local authorities, and provide a safe work area for workers and the general public.

1.02 PROTECTION OF EXISTING UTILITIES:

A. The Contractor shall provide whatever measures are necessary to properly protect and maintain all existing utilities encountered in the work.

B. The Contractor shall be solely and directly responsible to the utility owner for any and all damages to the various utilities, caused by the contractor's failure to adequately protect such utilities.

C. The Contractor shall notify utility owners that are affected during construction 48-hours in advance of the construction operation through the use of the Alabama 811 One Call system.

D. The Contractor shall cooperate fully with all utility owners in the event of interruption of service to the utility.

E. The Contractor shall maintain all storm sewers, drains and/or ditches so that flow is not disturbed.

F. The Contractor shall protect storm drains, inlets and/or ditches from damage during all testing, flushing, and disinfection processes.

1.03 PROTECTION AND ACCESS TO PUBLIC AND PRIVATE RIGHTS-OF-WAY:

A. The Contractor shall provide and maintain access to all public and private properties at all times. Roadways authorized closed by State or Local authorities shall be maintained to provide access to all fire, police, and other emergency vehicles and all individuals having private property in the closed area. The Contractor shall notify at least 24 hours in advance the local Fire, Police, and Transportation Departments, the Mayor's office, and any other individuals, businesses, or agencies that may be affected.

B. All driveways shall be protected and access maintained by the Contractor during the construction phase.

1.04 PROTECTION OF AIR QUALITY:

A. The Contractor shall minimize air pollution through the use of water or other devices on bare earth during dry, windy periods, the use of properly operating combustion emission control devices and by encouraging the shutdown of construction vehicles when not in use.

1.05 TRAFFIC CONTROL DEVICES:

A. The Contractor shall provide and maintain, in service at all times, traffic control devices, barricades, cones, flagmen, etc. as necessary and/or required by State and Local authorities.

B. The Contractor shall protect the public by adequately fencing, lighting, and/or flagging the construction work zone.

C. All traffic control devices shall conform to the Alabama Manual on Uniform Traffic Control Devices, Latest Edition.

1.06 SAFETY:

A. The Contractor shall do whatever work is necessary for safety and be solely and completely responsible for conditions of the jobsite, including safety of all persons (including employees) and property during the Contract period. This requirement shall apply continuously and not be limited to normal working hours and any subsequent warranty period associated with project deficiency or repair.

B. Safety provisions shall conform to the Federal and State Departments of Labor Occupational Safety and Health Act (OSHA), and all other applicable federal, state, county, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified in other parts of these Contract Documents. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth therein.

C. The Contractor shall at all times provide proper facilities for safe access to the work by authorized government officials (federal, state, county and local) and representatives of the Owner.

1.07 PAYMENT:

A. No separate payments shall be made for regulatory and safety requirements as costs for this item of work shall be incorporated in the various unit pricing of the work.

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 GENERAL:

A. This section of specifications covers the General Requirements for the preparation and assembly of submittals during the progress of the work. Any questions concerning the submittal process should be directed to the Engineer.

1.02 ADMINISTRATIVE SUBMITTALS:

A. All administrative submittals required in the Bid Documents, General Conditions, Supplementary Conditions, or Technical Specifications shall be provided by the Contractor. These submittals include but are not limited to payrolls, construction schedules, EEO documentation (if required), etc.

B. All permits to Federal, State or Local authorities shall be submitted promptly by the Contractor.

C. The Contractor shall submit on a daily basis the number of persons employed in the construction process, both Contractor and Subcontractor personnel, their classification, equipment used during the day, equipment added or deleted from the jobsite and the amount of work accomplished in each classification of work performed that day.

1.03 TECHNICAL SUBMITTALS:

A. All submittals shall be bound with a Table of Contents, clearly indicating all included material submittals.

B. Completely identify each submittal and re-submittal by showing at least the following information.

1. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

2. Name of project as it appears in the bid documents.

3. Drawing number and specifications section number to which the submittal applies.

4. Whether this is an original submittal or re-submittal.

C. Prior to submittal for Engineer's review, use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.

2. Coordinate as required with all trades and with all public agencies involved.

3. Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.

4. Clearly indicate all deviations from the Contract Documents.

Submittals will not be reviewed by the Engineer unless the above conditions are completed by the Contractor and denoted by the Contractor's stamp, indicating his review and approval.

D. Grouping of Submittals: Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items; the Engineer may reject partial submittals as not complying with the provisions of the Contract Documents.

E. General: Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery.

F. In scheduling, allow at least seven (7) full working days for the Engineer's review following his receipt of the submittal.

1. Delays: Cost of delays occasioned by tardiness of submittals may be back-charged as necessary to the Contractor and shall not be borne by the Owner.

1.04 SUBSTITUTIONS:

A. Engineer's Approval Required: The Contract is based on materials, equipment, and methods described in the Contract Documents:

1. The Engineer will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Engineer to evaluate the proposed substitution.

2. Do not substitute materials, equipment, or methods unless such substitution has been specifically accepted, in writing, for this work by the Engineer.

B. Or Equal: Where the phrase "or equal" or "or equal as approved by the Engineer" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the Engineer unless the item has been specifically accepted, in writing, for this work by the Engineer.

1. The decision of the Engineer shall be final.

1.05 SHOP DRAWINGS:

A. Scale Required:

1. Unless otherwise specifically directed by the Engineer, make all Shop Drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work.

B. Type of Prints Required:

1. Unless otherwise specifically directed by the Engineer, make all Shop Drawing prints in blue or black line on white background.

1.06 COPIES REQUIRED:

A. In general, unless directed otherwise by the Engineer, the Contractor's submittals shall be in sufficient quantities to allow four (4) copies to be retained by the Engineer.

1.07 WORK PERFORMED PRIOR TO SUBMITTAL ACCEPTANCE:

A. Any and all work performed by the Contractor prior to submittal review shall be at the Contractor's risk. No payment shall be made on items prior to a reviewed submittal.

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

1.01 GENERAL:

A. Temporary facilities and controls required for this Work include, but are not necessarily limited to:

1. Temporary utilities such as gas, water, electricity, and telephone;
2. Field offices and sheds;
3. Sanitary facilities;
4. Enclosures such as tarpaulins, barricades and canopies;
5. A project sign;
6. Fencing of the construction area;
7. Haul Road.

1.02 TEMPORARY UTILITIES:

A. The Contractor shall provide and pay all costs associated with the furnishing, installing, maintaining and removal of all temporary utilities.

B. Temporary utilities shall be in strict compliance with all federal, state and local codes and meet all safety requirements specified by OSHA and as necessary for good safety practice.

1.03 FIELD OFFICES AND OTHER FACILITIES:

A. The Contractor shall provide, maintain and remove as required field offices, sheds, and storage areas as needed in the work.

B. The Contractor shall provide and maintain a field office for the Engineer and Inspectors. The Contractor shall provide and pay for all utilities as required. The Contractor shall maintain such field offices in a clean and sanitary condition. **(NA)**

C. Engineer's field office shall meet the following minimum requirements: **(NA)**

1. Minimum floor Area: 400 square feet
2. Number of Offices: Two(2)
3. Toilet Facilities: One(1)
4. Minimum Number of Lockable Entrances: Two(2)
5. Heated and Cooled
6. Railed Stairway to Entrances
7. 110 Volt Wall Plugs
8. Ample lighting
9. One(1) 4' x 6' drawing table
10. One(1) 4-drawer metal file cabinet

D. The Contractor shall maintain such areas free of trash and debris, and store materials in a neat and orderly fashion.

E. The Contractor shall provide fencing and other materials as necessary for the proper protection of stored materials.

F. No sidewalk, private property, or right-of-way shall be used for storage of Contractor's equipment or materials unless a written authorization is obtained from the legal owner. A copy of the written authorization shall be provided to the Owner before final payment.

G. After completion of construction, the contractor shall remove all fencing, excess construction materials, etc. from private property, sidewalks and such and obtain a written release from the legal owner.

1.04 SANITARY FACILITIES:

A. The Contractor shall provide, maintain, and remove, as required, sanitary facilities for use by his employees, and subcontractor employees and comply with the regulations of state and local health department regulations and as directed by the Engineer.

B. The Contractor shall provide trash receptacles for use by his employees and subcontractor employees. No trash and/or refuse shall be allowed to be thrown into trenches during excavations on the project site. All such trash and/or refuse shall be removed at once even if it requires re-excavating.

1.05 PROJECT SIGN:

A. This project is being funded in whole or in part with ADEM DWSRF funds. As such, a project sign is required as described in the ADEM SRF requirements of the General Conditions.

B. The Contractor will consult with the Engineer and Owner as to the proper location of the project sign.

END OF SECTION

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Cleaning shall include daily "policing" of the work and surrounding areas to clear general debris, waste paper, wood scraps, broken concrete, and other objectionable material along with the final cleanup of site(s) required for project acceptance. **DAILY CLEANUP IS REQUIRED.**

1.02 DISPOSAL REQUIREMENTS

Conduct cleaning and disposal operations to comply with codes, ordinances, and regulations of the city or county in which the work is performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

The Contractor shall execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris resulting from construction operations. The Contractor shall provide on-site containers for the collection of waste materials, debris, and rubbish. All waste materials including containers, food debris, and other miscellaneous materials must be disposed of daily in on-site containers. The Contractor shall remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas away from the site. Burning of waste material shall not be permitted.

3.02 FINAL CLEANING

The Contractor shall remove all mud, dirt, and debris from all paved surfaces at the completion of the Project. The Contractor shall remove all mud, dirt, and debris from all sewer and drainage systems at the completion of the Project. The Contractor shall remove all erosion control items once permanent vegetation is established.

END OF SECTION

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall maintain for the Owner one record copy of:

A. Drawings

B. Change Orders and other modifications to the Contract

C. Owner's Field Orders or written instructions

D. Approved Shop Drawings, Working Drawings, and Samples

E. Field Test records

F. Latest Approved Progress Schedule

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

The Contractor shall store documents and samples apart from documents used for construction. The Contractor shall maintain documents in a clean, dry, legible condition and in good order. The Contractor shall not use record documents for construction purposes. The Contractor shall make documents and samples available at all times for inspection by the Owner. As a prerequisite for monthly progress payments, the Contractor shall exhibit the currently updated "record documents" for review by the Owner.

1.03 RECORDING

The Contractor shall label each document "PROJECT RECORD" with rubber stamp. The Contractor shall record information concurrently with construction progress and shall not conceal any work until required information is recorded. The Contractor shall legibly mark drawings to record actual construction:

A. Elevations of various structure elements in relation to elevation datum.

B. All underground piping with elevations and dimensions, changes to piping location, horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements, actual installed pipe material, class, etc.

C. Location of internal utilities and appurtenances concealed in the construction by referencing to visible and accessible features of the structure.

D. Field changes of dimension and detail.

E. Changes made by Field Order or by Change Order.

F. Details not on original contract drawings.

G. Equipment and piping relocations.

H. Shop Drawings (after final review).

The Contractor shall provide one set of approved shop drawings for each process equipment, piping, electrical system, and instrumentation system.

1.04 SUBMITTAL

At contract close-out, the Contractor shall deliver Record Drawings to the Owner and the Local Authorities. Final payment to the Contractor shall not be made until receipt of acceptable Record Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01800 - DETERMINATION OF PAY QUANTITIES & PAYMENT

1. Mobilization and Demobilization (Item #1.0) – Payment for "Mobilization and Demobilization" shall be made at the unit price bid, per lump sum, and shall be compensation in full for furnishing all materials, equipment, tools, labor and incidentals necessary to complete the work. The value of this bid item shall not exceed 7% of the total bid price. No additional payment, above the bid amount for this pay item, shall be made regardless of the fact that the Contractor may have, for any reason, shut down work on the project and/or moved equipment away from the project and back again. Payment of 25% of the mobilization bid amount shall be made on the first estimate. Payment for the remaining 75% of the bid amount shall be prorated based on the work completed on each subsequent application for payment.

2. Building and Equipment Demolition (Item #2.0) – Payment for "Building and Equipment Demolition" shall be made at the applicable lump sum price bid, and shall be compensation in full for furnishing all materials, equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, building demolition work, and demolition and removal of aerator equipment, high service pumps, and miscellaneous outdoor components and piping. No extra payment will be made for site preparation, special equipment, or cleanup work, but costs for these items shall be included in this pay item.

3. Rehabilitate Existing Clearwell (Item #3.0) – Payment for "Rehabilitate Existing Cleawrwell" shall be made at the applicable lump sum price bid, and shall be compensation in full for furnishing all materials, equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, cleaning the existing clearwell floor and walls, application of new interior waterproof coating, installation of guardrails around the perimeter of the existing valve pit, and installation of 6" perimeter underdrain piping. No extra payment will be made for special equipment or cleanup work, but costs for these items shall be included in this pay item.

4. Furnish and Install New High Service Vertical Turbine Pumps, Pump Discharge Piping, Valves, Flow Meter, and New 4" Discharge Pipe (Item #4.0) – Payment for Item #4 shall be made at the lump sum price bid, and shall be compensation in full for furnishing all equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, connecting well discharge head pipes, connecting electrical conductors, installing pressure gauge, installing ultrasonic level sensor and extending signal cable, and any needed fittings and couplings to completely install the new high service pumps, valves, piping, flow meter assembly, plus any needed incidentals to provide the equipment completely installed and ready for operation. No extra payment will be made for miscellaneous site work, required testing, special equipment, cleanup work, etc. but costs for these items shall be included in this pay item.

5. Improvements and Refurbishment of Existing Building (Item 5.0) – Payment for "Improvements and Refurbishment of Existing Building" shall be made at the lump sum price bid, and shall be compensation in full for furnishing all equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, installing all new windows, lighting, electrical components, and new roof structure, refurbishment of ceiling,

replacement of doors and hardware as required, replacement of water piping along with installation of new backflow preventer assembly, installation of minor equipment such as new eyewash station and safety equipment, plus all necessary miscellaneous incidentals to complete the work and provide a completely refurbished building, ready for operation. No extra payment will be made for special equipment or cleanup work, but costs for these items shall be included in this pay item.

6. Furnish and Install New Chemical Feed and Chlorination Equipment (Item #6.0) – Payment for "Installation of New Chemical Feed and Chlorination Equipment" shall be made at the lump sum price bid, and shall be compensation in full for furnishing all equipment, tools, labor and incidentals necessary to complete the work, including installation of a new chloring gas feed system and chlorine solution piping, Cl_2 gas vacuum sensor, Cl_2 gas leak detector, chemical metering pumps, chemical reservoirs, chemical tubing, plus all related equipment and any necessary miscellaneous incidentals to complete the work and provide a completely installed chlorination system and chemical feed systems, ready for operation. No extra payment will be made for special equipment or cleanup work, but costs for these items shall be included in this pay item.

7. Furnish and Install New Concrete Slab, Generator, and Fuel Tank (Item #7.0) – Payment for "Furnish and Install New Concrete Slab, Generator, and Fuel Tank" shall be made at the lump sum price bid, and shall be compensation in full for furnishing all equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, installation of concrete base slab, generator with integral fuel tank, automatic transfer switch, electrical conduits and conductors and connection to electrical equipment in the building, screening fence around generator, plus all related equipment and any necessary miscellaneous incidentals to complete the work and provide a completely installed generator, ready for operation. No extra payment will be made for special equipment or cleanup work, but costs for these items shall be included in this pay item.

8. Furnish and Install New Aerator and Blower Equipment (Item #8.0) – Payment for "Furnish and Install New Aerator and Blower Equipment" shall be made at the lump sum price bid, and shall be compensation in full for furnishing all equipment, tools, labor and incidentals necessary to complete the work, including but not limited to, installing new gate valve, new aerator tower and interior cascade assembly, new blower and motor assembly, conduits and electrical conductors to the building equipment room, and any needed pipe segments to install the new aerator. No extra payment will be made for special equipment or cleanup work, but costs for these items shall be included in this pay item.

END OF SECTION

SECTION 01810 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of specifications outlines the general procedures to be followed for the closeout of all contracts.

1.02 SUBSTANTIAL COMPLETION:

A. The substantial completion date for each portion of work shall be as established by the General Conditions and the Contract. The Contractor should be aware that the Owner may desire to place portions of the work into service prior to completion of the contract. The Contractor should refer to the Contract Documents for phases of work to be placed in service.

1.03 FINAL INSPECTION:

A. Upon final cleaning and written notice from the Contractor that the work is completed, the Engineer will make a preliminary inspection with the Owner and Contractor present. Upon completion of the preliminary inspection, the Engineer will notify in writing any defective or incomplete work revealed by the inspection.

B. Upon receiving notification from the Engineer, the Contractor shall immediately proceed to remedy all punch list items to the satisfaction of the Owner.

C. The Contractor shall inform the Engineer in writing that he has completed or corrected all punch list items, and desires final inspection. The Engineer, in the presence of the Owner and Contractor shall make a final inspection of the project.

D. Should the Engineer find all work to be satisfactory, the Contractor may make application for final payment in accordance with the General Conditions of the Contract. Should the Engineer find deficiencies in the work, the Engineer will inform the Contractor and deny any request for final payment until such deficiencies are corrected to the satisfaction of the Owner and Engineer.

1.04 FINAL SUBMITTALS:

A. The contract shall not be finalized and final payment shall be withheld until all submittals, shop drawings, as-built drawings, keys, etc. are submitted to the Engineer. All guarantees, bonds, affidavits, releases shall be finalized and satisfactorily submitted to the Engineer before final payment is made. Final payment shall be withheld until satisfactory evidence of release of all liens and claims against the contractor have been submitted to the Engineer.

END OF SECTION

SECTION 02250 - TRENCHING, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section of Specifications deals with the requirements for Trenching, Backfill, and Compaction for utility lines placed in roadways, lawns or unimproved property or any other areas.

1.02 PAYMENT:

A. Payment for trenching, bedding, backfill, and compaction shall be considered incidental to the cost of the pipe, and no separate payment shall be made.

B. No separate payment shall be made for sloping back of trench walls, shoring, blasting, fence removal and replacement, or the protection and/or replacement of plants, trees, structures, etc. In general, the condition after construction shall be as good, or better, than before construction. No payment will be made unless specifically itemized in the Bid Schedule.

1.03 REFERENCES:

A. U.S. Department of Labor, Occupational Safety and Health Administration.

B. State of Alabama Department of Transportation Standard Specifications for Highway Construction.

1.04 PROJECT CONDITIONS:

A. Environmental Requirements:

1. The Contractor shall maintain all drainage ways, gutters, etc., at all times. The Contractor at his own expense shall remove any eroded or washed material that enters pipes, ditches, or streams.

2. The Contractor shall provide erosion control as required to protect surrounding areas from damage.

3. All areas damaged as a result of erosion shall be repaired to a condition equal or better than the condition prior to construction, as determined by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Select Backfill:

1. Unless otherwise shown on the Construction Plans, ***Initial Select Backfill*** to be installed around the pipe shall be No. 8910 crushed limestone meeting or exceeding the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition.

2. Unless otherwise shown on the Construction Plans and not including the initial select backfill around the pipe, ***Select Backfill*** where specified or required shall be No. 57 crushed stone. Crushed stone shall meet or exceed the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition, Section 801.

B. Standard Backfill:

1. Standard backfill shall consist of native soils free of large rocks, boulders and other deleterious substances.

C. Bedding:

1. Class "1" Bedding shall be Alabama Department of Transportation Standard Specifications for Highway Construction, Section 801, No. 8910 or No. 57 crushed limestone as specified in the plans.

2. Class "2" Bedding shall be reinforced concrete 3000 psi design mix.

3. Unless specified on the drawings or required by the Engineer, pipe shall be bedded in native soil (Class "3").

D. Trench Foundation

1. Trench foundation material shall be Alabama Department of Transportation Standard Specifications for Highway Construction, Section 801, No. 2 crushed limestone. This material shall only be used when approved in advance by the Engineer.

2.02 SOURCE QUALITY CONTROL:

A. The Contractor shall supply gradation analysis for each type of crushed stone used.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS:

A. The Contractor shall examine the area to be trenched and verify his requirements for trenching.

3.02 PROTECTION AND REMOVALS:

A. Fences:

1. All fences in conflict with the proposed construction shall be removed in a neat and

workmanlike manner and then replaced immediately following construction operations. Where materials removed are not suitable for reuse, they shall be replaced with new material of equal or better quality and construction. All fences shall be rebuilt to line, with posts well set, wires fastened with new staples or ties and well stretched. All corner and end posts shall be well braced and set a minimum of 30 inches in the ground.

B. Utility Poles, Guy Wires, Miscellaneous Poles, Etc.:

1. All utility poles, guy wires, sign posts and similar private obstructions which are indicated on the plans or existing on the ground shall be removed and replaced by the Contractor at his own expense. In the event street signposts or signs are damaged or destroyed by the Contractor's operations, they may be replaced by the Owner at the Contractor's expense.

2. When it is necessary to remove or adjust any utilities, representatives of the utilities involved shall be notified to decide the method and nature of work to be done. The Contractor shall make satisfactory arrangements with other utilities for the required removal or adjustments at the Contractor's expense, unless otherwise specified.

3. The Contractor shall be held liable for damage, including negligent or willful damage to any other utility and shall pay for the cost of all necessary repairs and any damages resulting to public or private property resulting therefrom.

4. The Contractor shall take whatever means necessary to support sewer mains to their true line and grade when they are encountered during excavation. The pipe shall be supported so that no leakage will occur and under no circumstances will the Contractor be allowed to bypass raw sewage or allow raw sewage to leak into the trench. If a repair becomes necessary the contractor shall use materials of the same type and class of pipe. All couplings to existing pipe shall be manufactured couplings and all metal parts shall be stainless steel.

C. Ornamental Shrubs and Trees:

1. Ornamental shrubs and trees shall not be removed unless directed by the Engineer. When ornamental shrubs and/or trees are to be removed and replaced, the following steps shall be followed:

   a. Remove all trees, shrubs or plants, which interfere with construction with root system intact and protect from drying during construction period.

   b. Replace plant to original location as soon as possible, ensure that hole is large enough, and no damage is done to root system.

   c. Fill hole with good topsoil and tamp lightly and firmly into place and water plant.

2. Contractor shall replace any plant, tree, or shrub which is disturbed by construction and dies within 1 year with like kind and size, at no cost to the Owner.

D. Adjacent Property:

1. The Contractor shall confine his operations to the rights-of-ways and/or easements designated. The Contractor shall repair any damage to adjacent property at no additional cost to the Owner.

E. Private Drives and Sidewalks:

1. The Contractor shall keep all private drives and sidewalks open and accessible at all times.

2. All streets and public roads shall be kept open and accessible to emergency vehicles at all times.

F. Existing Underground Utilities:

1. The Contractor shall protect all existing utilities during the trenching operation. The Contractor shall cooperate fully with the utility's requests for temporary and permanent supports during the trenching operation and shall furnish and install supports at no additional cost to the Owner.

2. Storm sewers in conflict with the proposed trench may be carefully dislodged and stockpiled. The pipes shall be cleaned and replaced immediately after new construction is clear. Storm sewers damaged by the Contractor shall be replaced with new pipe at no additional cost to the Owner. All storm sewers removed shall be re-laid to proper grade on a firm bedding so that settlement will not occur.

3.03 TRENCH PREPARATION:

A. Clearing and Grubbing:

1. Where clearing or partial clearing of the right-of-way or easements is necessary, such work shall be completed prior to trench excavation. Projecting materials such as trees, logs, brush, hedges, etc., shall be cut as near to the surface of the ground as possible, and all stumps and roots shall be grubbed out unless specifically stated otherwise. All materials so cleared and grubbed shall be removed from the site. In no case shall excavated materials be allowed to cover brush or trees prior to disposal. Clearing and grubbing costs shall be included in the unit price bid for the related pipe unless a specific line item for clearing and grubbing is included in the bid schedule.

2. The Contractor shall bear all costs of disposing of all cleared and grubbed materials. Unless otherwise specified, all merchantable timber cut from the area designated to be cleared shall become the property of the Contractor.

3. Burning will be permitted, provided the Contractor obtains permits and meets the requirements of the proper fire authorities and any other state, county or local ordinances. Burning on private property will not be permitted without written

permission of the Owner of the property. The authority to burn shall in no way relieve the Contractor from damages, which may result from his operations. **(BURNING NOT PERMITTED ON THIS PROJECT)**

4. In no case shall any materials from clearing and grubbing operations be left on the project, or be pushed onto abutting private properties, or be buried in embankments or trenches on the project.

5. On public property, existing trees or limbs over 2 inches in diameter shall not be cut unless they are within 7 feet of pipe centerline or specific permission is received from the Engineer. On private easements or in lawns, no trees or brush shall be cleared or cut without prior approval of the Engineer or Inspector. The Contractor shall be required to remove trees, shrubs or plants on private property intact, and to ball the roots, keep watered as required, and replant in their original location upon completion of pipe laying operations, unless written permission is obtained from the Engineer, or unless otherwise specified. The Contractor shall replace, at his own expense, any trees, shrubs, or plants which are damaged as a result of his operations, or which die within 1 year of the time it was disturbed or damaged.

B. Saw Cutting:

1. Prior to beginning the trenching operation in paved areas such as roads, drives, and parking lots, all paving shall be saw cut to a minimum depth of 2 inches in neat and straight lines. Saw cuts shall be situated to allow for proper trench widths as noted on the detail drawings. All paving materials shall be removed and disposed of prior to the trenching operation.

2. Prior to beginning the saw cutting, all traffic control devices, barricades, cones and permits required shall be obtained and in place.

C. Verification of Existing Utilities:

1. Prior to the excavation but after the saw cutting in paved areas, the Contractor shall unearth all known utilities and confirm the location and depth of such utility sufficiently far enough in advance to adjust the vertical or horizontal alignment of the pipeline if necessary.

3.04 TRENCH CONSTRUCTION:

A. General:

1. Trenching or excavation for pipe lines shall consist of the excavation necessary for the installation of sanitary or storm sewers, water lines, gas lines, and other utilities and all appurtenant facilities, including manholes, junction boxes, inlets, outlets, thrust blocks, and pipe protection as called for on the Drawings.

2. Trench excavation shall be made in an open cut unless tunneling or other construction methods are specifically authorized, and shall be true to the lines and grades shown on

the plans or established by the Engineer.

3. When vertical banks for trench excavation are not practical to construct or create dangerous conditions to workmen, the banks may be sloped provided that such excavation does not damage adjacent structures. However, when trench banks are sloped, such banks shall be cut to vertical planes as specified above for that part of the ditch below the level of one (1) foot above the top of the pipeline.

4. All streets, sidewalks, crossings, fire hydrants, water valves, fire alarm boxes and other similar public utilities are to be kept open or accessible for their intended use.

5. Every drain, gutter, culvert, or sewer for surface drainage encountered is to be kept open for both temporary and permanent flow, or if necessarily closed, other adequate provision for drainage is to be made.

6. In all cases where materials are deposited along open trenches, they shall be placed so that in the event of rain, no damage will result to the work and/or to adjacent property.

7. Pipe trenches shall not be excavated more than 300 feet in advance of pipe laying and temporary bridges or cross walks shall be constructed where required to maintain vehicular or pedestrian traffic.

8. Trench widths shall be confined to dedicated rights-of-way or construction easements, unless special written agreements have been made with the affected property owner. Place all excavated materials within easements or rights-of-way, and do not obstruct any public or private roadways or streets.

9. Where select backfill is specified or required, all excavated materials shall be promptly removed and disposed of by the Contractor.

B. Rock Excavation:

1. Rock encountered in trench excavation for pipe lines shall be removed for the over-all width of trench and to a depth of 6-inches below the bottom of the barrel of pipe 24-inches in diameter and smaller, and 8-inches below the bottom of pipe 24 to 36 inches in diameter, and 12-inches below pipe larger than 36-inches in diameter, if rock extends to such depths.

2. Where pipelines are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle as shown on the plans. When necessary to provide sufficient working space, rock shall be excavated to additional depth for bell holes.

3. After the Engineer has inspected the completed excavation, the space below the ultimate pipe or structure grade shall be filled with an approved foundation material and compacted to the proper grade.

4. Drilling and blasting methods used in rock excavation shall be optional with the Contractor but shall be conducted with due regard to the safety of persons and property

in the vicinity of the work and in strict conformity with all laws, ordinances, or regulations governing blasting and the use of explosives. The Contractor shall be licensed for this type of blasting and shall follow the insurance requirements of the general conditions. The Contractor shall also notify the fire department at least 48 hours in advance of any blasting. **(DRILLING AND BLASTING WILL NOT BE ALLOWED ON THIS PROJECT)**

5. Rock excavation near existing structures of all types shall be conducted with the utmost care, and every precaution shall be taken to prevent damage to such structures. Any damage or injury of whatever nature to persons or property caused directly or indirectly by blasting operations shall be promptly repaired, replaced, or compensated for by the Contractor at his own expense and to the satisfaction of the persons injured or the owners of the property damaged.

C. Sheeting, Shoring and Bracing:

1. The sides of all trenching excavations shall be sufficiently sheeted, shored, and braced whenever necessary to prevent slides, cave-ins, settlements or movement of the banks and to maintain the excavation clear of obstructions that will, in any way, hinder or delay the progress of the work.

2. Wood or steel sheet piling of ample design and type shall be used when necessary.

3. All sheeting, shoring, and bracing shall have sufficient strength and rigidity to withstand the pressures exerted and to maintain the walls of the excavation properly in place and protect all persons and property from injury or damage.

4. Where excavations are made adjacent to existing buildings or other structures, or in paved streets or alleys, the Contractor shall take particular care to sheet, shore and brace the sides of the excavation adequately so as to prevent any undermining of or settlement beneath such structures or pavement. Underpinning of adjacent structures shall be done when necessary. The Contractor will be liable for any damage to any structure that results from his operations.

5. Sheeting, shoring or bracing materials shall not be left in place unless so shown by the plans or ordered by the Engineer. Such materials shall be removed in such manner as will not endanger or damage the new structure or any existing structures or property, either public or private, in the vicinity, and so as to avoid cave-ins or slides. No trench sheeting and bracing shall be removed until the trench has been backfilled one foot above the top of the pipe.

D. Trenching Through Dikes or Fill Sections:

1. Trenching through existing dikes or fill sections shall be accomplished in accordance with general trenching requirements as specified elsewhere.

2. Trenching for pipe lines or other utilities through dikes or fill sections under construction shall not begin until the new dike or fill section has been constructed,

enlarged, or otherwise improved to an elevation 3 feet above the top of the pipe or other utility being installed.

3. Where existing dikes or fill sections are being used for the storage of liquids such as a lagoon, reservoir, pond, lake, canal, or other structure, the Contractor shall take whatever means necessary to preserve the integrity of the structure. No leakage of the stored liquid out of the structure will be allowed without the written approval of the owners of said structure.

E. Minimum Trench Widths:

1. All excavations shall be made to the lines and grades as established by the drawings, and shall be open cut through whatever material encountered. The Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such changes can be made within the easement right-of-way without adversely affecting the intended function of the facility. In areas where soil conditions permit normal excavation of the trench, the sides shall be cut as nearly vertical as possible from the bottom of the trench to a point at least 12 inches above the top of the pipe. The trench width shall conform to Table 2 of the AWWA C600 Specification.

3.05 DEWATERING:

A. The Contractor shall at all times provide and maintain the necessary equipment and means for removal of all water from excavated areas. All excavated areas shall be kept free of water while any work is in progress. Particular precautions shall be taken to prevent the displacement of structures or pipelines as a result of accumulated water.

B. Bedding material or pipe shall not be placed in wet or unstable trenches. Soil that cannot be properly dewatered shall be excavated and dry material tamped in place to such a depth as may be required to provide a firm trench bottom.

C. All water removed or diverted from excavations shall be disposed of in a manner that will prevent damage to adjacent property or any flooding of streets or property. Disposal of trench water through the pipeline under construction shall not be allowed.

D. Water shall be removed and disposed of so as to not damage adjacent property or existing drainage ways.

3.06 TRENCH FOUNDATION MATERIAL:

A. Where unsuitable materials for supporting pipe cushion are encountered, these materials shall be removed and replaced with trench foundation material, as directed by the Engineer.

B. Trench foundation material shall be placed at the specified trench width from the bottom of the excess excavation to the bottom grade line of the pipe cushion.

C. Trench foundation material so placed shall be as shown on the trench detail drawings or specified herein. If not shown on the drawings, trench foundation material shall consist of Alabama Department of Transportation Standard Specifications for Highway Construction, Section 801, No. 2 crushed limestone.

D. Payment for trench foundation material will be limited to situations approved in advance by the Engineer.

3.07 BEDDING AND BACKFILL:

A. General:

1. All areas where bedding is not specifically called for or required by the Engineer, the pipe shall be bedded in native soils. Bell holes shall be excavated so that the entire pipe length rests on firm soil.

2. Areas undercut by the Contractor through negligence, or his convenience, shall be backfilled and tamped with approved materials at the expense of the Contractor. In paved areas, the backfill material shall be select backfill.

3. Bedding shall meet the requirements of Paragraph 2.01 of these specifications.

4. Backfilling shall not begin before the Engineer or Inspector has inspected the grade and alignment of the pipe.

5. If select backfill is not specified, backfilling to a point 12-inches above the top of the pipe, defined as the pipe zone, shall be done with good earth, sand or gravel and shall be free from large rocks or hard lumpy materials. Large rocks shall be defined as any larger than 2-inches in diameter. No materials of perishable, spongy or otherwise unsuitable nature shall be used in backfilling. It is essential that the completed backfill be done in such a manner as to minimize voids in the backfill.

6. Place trench backfill material at approximately the same rate along both sides of the pipe and compact by tamping in layers not to exceed 8 inches of loose fill up to the horizontal centerline of the pipe. The intent is to cradle the pipe so that the full length is uniformly supported on firm bedding and the weight of the pipe and backfill is borne uniformly by the lower half of the pipe barrel. Special attention should be given to the backfilling and tamping procedures to insure that no voids or un-compacted areas occur beneath the pipe. The use of granular material for backfill in the pipe zone shall constitute a pay item only when so directed by the Engineer. After this, fill and compact the trench as specified below, depending upon the location of the work and danger from subsequent settlement.

7. All backfilling shall be done in such a manner that will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged, or moved from its proper line or grade during backfilling operations, shall be replaced or repaired and then re-backfilled as herein specified, at the expense of the Contractor.

B. Trench Backfill and Pipe Bedding:

1. Pipe bedding and trench backfill shall be constructed as shown on the drawings for trench details. If no trench details are shown on the drawings, then the Contractor shall install the utilities as described in Paragraphs 3.07 B.3 and 3.07 B.4.

2. Where pipes are installed in unpaved areas, unless specifically shown on the drawings or called out in the Bid Schedule to be improved, the areas shall be considered to be ***Un-Improved*** areas and shall be constructed accordingly.

3. Pipe Bedding and Trench Backfill – ***Gravity Pipe***:

a. Under Pavement (Asphalt or Concrete and/or Gravel Drives):

Pipe Material – Ductile Iron and Concrete

Bedding –	6" ALDOT No. 57 crushed limestone
Initial Backfill –	Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to springline in max. 8" loose layers mechanically compacted
Final Backfill –	Select backfill ALDOT No. 57 to top of trench in maximum 8" layers mechanically compacted

Pipe Material – PVC

Bedding –	6" ALDOT No. 57 crushed limestone
Initial Backfill –	Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to 6" above top of pipe in maximum 8" loose layers mechanically compacted
Final Backfill –	Select backfill ALDOT No. 57 to top of trench in maximum 8" layers mechanically compacted

b. Improved Areas:

Pipe Material – Ductile Iron

Bedding –	6" ALDOT No. 57 crushed limestone
Initial Backfill –	Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to springline in max. 8" loose layers mechanically compacted
Final Backfill –	Standard backfill to top of trench in maximum 8" loose layers compacted to 98% SPD

Pipe Material – Concrete

Bedding –	Class 3 Native Material *
Initial Backfill –	Standard backfill to top of trench in maximum 8" loose layers compacted to 98% SPD
Final Backfill –	Standard backfill to top of trench in maximum 8" loose layers compacted to 98% SPD

Pipe Material – PVC
Bedding – 6" ALDOT No. 57 crushed limestone
Initial Backfill – Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to 6" above top of pipe in maximum 8" loose layers mechanically compacted
Final Backfill – Standard backfill to top of trench in maximum 8" loose layers compacted to 98% SPD

c. Unimproved Areas:

Pipe Material – Ductile Iron
Bedding – 6" ALDOT No. 57 crushed limestone
Initial Backfill – Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to springline in max. 8" loose layers mechanically compacted
Final Backfill – Standard backfill to top of trench in maximum 8" loose layers compacted to 90% SPD

Pipe Material – PVC
Bedding – 6" ALDOT No. 57 crushed limestone
Initial Backfill – Select Backfill ALDOT No. 57 crushed limestone from bottom of pipe to 6" above top of pipe in maximum 8" loose layers mechanically compacted
Final Backfill – Standard backfill to top of trench in maximum 8" loose layers compacted to 90% SPD

4. Pipe Bedding and Trench Backfill – ***Pressure Pipe***:

a. Under Pavement-Asphalt or Concrete and/or Gravel Drives:

Pipe Material – Ductile Iron
Bedding - Class 3 Native Material *
Initial Backfill – Select backfill ALDOT No. 57 crushed limestone from bottom of pipe to springline in maximum 8" loose layers mechanically compacted
Final Backfill – Select backfill to top of trench ALDOT No. 57 crushed limestone in maximum 8" layers mechanically compacted

Pipe Material – PVC
Bedding - Class 3 Native Material *
Initial Backfill – Select backfill ALDOT No. 8910 crushed limestone from bottom of pipe to 12" above top of pipe in maximum 8" loose layers compacted to 98% SPD
Final Backfill – Select backfill to top of trench ALDOT No. 57 crushed limestone in maximum 8" layers mechanically compacted.

b. Improved Areas:

Pipe Material – Ductile Iron and/or PVC

Bedding –	Class 3 Native Material *
Initial Backfill –	Standard backfill from bottom of pipe to springline in maximum 8" loose layers compacted to 98% SPD
Final Backfill –	Standard backfill to top of trench in maximum 8" loose layers compacted to 98% SPD

c. Unimproved Areas:

Pipe Material – Ductile Iron and/or PVC

Bedding –	Class 3 Native Material *
Initial Backfill –	Standard backfill from bottom of pipe to springline in maximum 8" loose layers compacted to 90% SPD
Final Backfill –	Standard backfill to top of trench in maximum 8" loose layers compacted to 90% SPD

**** Where trench bottom is rock provide 6" layer of trench foundation material as approved by the Engineer.***

3.08 CLEANING:

A. The Contractor shall thoroughly clean all areas damaged during construction of excess fill, construction debris, etc.

B. All gutters and adjacent curbing shall be swept clean of debris and materials that may hinder storm water flow.

3.09 PROTECTION:

A. The Contractor shall protect the newly constructed pipeline from damage until final acceptance of the work.

END OF SECTION

SECTION 02290 – SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. This section of specifications covers the requirements of the contractor to protect the project site and adjoining properties from soil erosion and runoff. This Section reviews methods of construction, erosion control measures, maintenance of erosion control features, and construction runoff permitting.

1.02 RELATED SECTIONS:

A. Section 02250 – Trenching, Backfill, and Compaction

B. Section 02920 – Seeding and Mulching

PART 2 MATERIALS

2.01 TEMPORARY BERMS:

A. A temporary berm is constructed of compacted soil or riprap, with or without a shallow ditch, at the top of fill slopes or transverse to the centerline of fills. These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2.02 TEMPORARY SLOPE DRAINS:

A. A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the Engineer that may be used to carry water down slopes to reduce erosion.

2.03 SEDIMENT STRUCTURES:

A. Sediment basins, ponds, and traps are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.04 CHECK DAMS:

A. Check dams are barriers composed of logs and poles, large stones, or other materials placed across a natural or constructed drainway.

2.05 TEMPORARY SEEDING AND MULCHING:

A. Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes, including waste sites and borrow pits, shall be seeded when and where necessary to control erosion. Temporary seeding and mulching shall conform to the requirements of Section – Seeding and Mulching.

2.06 BRUSH BARRIERS:

A. Brush barriers shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation.

B. Brush barriers are placed on natural ground at the bottom of fill slopes, where the most likely erodible areas are located, to restrain sedimentation particles.

2.07 BALED HAY OR STRAW CHECKS:

A. Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw, containing five (5) cubic feet or more of material.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water runoff is a problem.

2.08 TEMPORARY SILT FENCES:

A. Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

2.09 WATTLES:

A. Wattles shall be a tubular shaped product specifically manufactured for erosion and sediment control. Biodegradable wattles shall be manufactured using interwoven biodegradable plant material such as straw, coir or wood shavings in biodegradable or photodegradable netting that is of sufficient strength to resist damage during handling, installation and use. Minimum wattle diameter shall be 20 inches. Acceptable manufacturers of wattle products may be found in ALDOT List II-24 of the ALDOT Manual “Materials, Sources and Devices with Special Acceptance Requirements.

PART 3 EXECUTION

3.01 GENERAL:

A. The Contractor shall obtain an NPDES permit in accordance with requirements of this section and in compliance with regulations established by the EPA and the ADEM.

B. The Contractor shall exercise planning and forethought in coordinating the work of protecting the project and adjoining properties from soil erosion by effective and continuous erosion control methods of either a temporary or a permanent nature.

C. Prior to construction, the Contractor shall meet with the Engineer and review in detail the expected problem areas in regard to the erosion control work. Different solutions shall be discussed so that the best method might be determined. It is the responsibility of the Contractor to develop an erosion control plan acceptable to the Engineer. Erosion control measures shown on the Drawings or in Standard Details are the minimum required and are meant as a guide for the Contractor.

D. Before beginning work on the site, the Contractor shall submit to the Engineer, for his review and approval, a plan for control of soil erosion.

E. The Contractor shall plan his clearing work and his entire construction operations in such a manner as to effectively control soil erosion and prevent pollution of streams, ponds, and/or drains as would result from silt or soil runoff or as would result from any materials used in the construction operations such as oil, grease, paints, chemicals, or any construction debris.

F. The Contractor shall intercept and block drainage from the construction site by means of silt fences, silt barriers, sedimentation pools or other measures as required.

G. Silt fences, wherever used on the site, shall consist of hay bales securely fastened in place or, if approved, permeable-barrier fabric designed to filter water and retain silt. Fabric shall be set securely in the ground and firmly held in place.

H. The erosion control work shall cover all disturbed areas within the project and/or easement along which the project has been installed. Erosion control work shall not be limited to the easement but shall include all disturbed areas as necessary.

3.02 METHODS OF CONSTRUCTION:

A. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches, and settling basins.

B. Construction operations shall be restricted to the areas of work indicated on the Plans and to the area which must be entered for the construction of temporary or permanent facilities. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

C. Excavated soil material shall not be placed adjacent to wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the Engineer. If, for any reason, construction materials are washed away during the course of construction, the Contractor shall remove those materials from the fouled areas as directed by the Engineer at no cost to the Owner.

D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of the easements.

E. The Contractor shall not pump silt-laden water from trenches or other excavations into wetlands or adjacent watercourses. Instead, silt-laden water from excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.

F. Prohibited construction procedures include, but are not limited to, the following:

1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface water areas.

3. Pumping of silt-laden water from trenches or excavations into surface waters or wetlands.

4. Damaging vegetation adjacent to or outside of the construction area limits.

5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in wetlands, surface waters, or unspecified locations.

6. Permanent or unauthorized alteration of the flow line of any stream.

G. Any temporary working roadways required shall be clean fill approved by the Engineer. In the event fill is used, the contractor shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

3.03 EROSION CHECKS:

A. The Contractor shall furnish and install baled hay or straw erosion checks in all locations indicated on the Plans, surrounding the base of all deposits of stored excavated materials outside of the disturbed area, and where indicated by the Engineer. Checks, where indicated on the Plans, shall be installed immediately after the site is cleared and before excavation has begun at the locations indicated. Checks located around stored material shall be located approximately 6-feet from that material. Bales shall be held in place with two 2-inches by 2-inches by 4-feet wooden stakes. Each bale shall be butted tightly against the adjoining bale to preclude short-circuiting of the erosion check.

3.04 MAINTENANCE OF EROSION CONTROL FEATURES:

A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

B. Silt fences shall have sediment deposits removed if it reaches a depth of fifteen inches (15”) or ½ the height of the fence. Sediment removed from the silt fence shall be removed from the site.

C. In the event that temporary erosion and pollution control measures are required due to the Contractor’s negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.

3.05 CONSTRUCTION RUNOFF PERMITTING:

A. A Construction Storm Water permit will be required for this project and application has been made by the Gordo Water, Gas and Sewer Board. Prior to beginning work, the Contractor shall apply to ADEM and have this permit transferred into the Contractor’s name. No payment for any pay quantities shall be made until the Contractor successfully transfers this permit and submits evidence of the successful transfer to the Owner and Engineer. In addition, the Contractor shall use Construction Best Management Practices in containing erosion and preventing siltation from damaging any streams or nearby properties.

END OF SECTION

SECTION 02600 - DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This section of specifications covers the material and installation requirements for ductile iron pipe and fittings.

B. The testing requirements for materials, in-place, specified under this section shall conform to Section – Water System.

1.02 RELATED SECTIONS:

A. Section 02250 – Trenching, Backfilling, and Compaction

B.

C. Section 02660 – Water System

1.03 REFERENCES:

A. ANSI/AWWA C104/A21.4 – American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

B. ANSI/AWWA C105/A21.5 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

C. ANSI/AWWA C110/A21.10 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in., for water and other liquids.

D. ANSI/AWWA C111/A21.11 – American National Standards for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

E. ANSI/AWWA C115/A21.15 – American National Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

F. ANSI/AWWA C150/A21.50 – American National Standard for the Thickness Design of Ductile-Iron Pipe.

G. ANSI/AWWA C151/A21.51 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.

H. ANSI/AWWA C153/A21.53 – American National Standard for Ductile-Iron Compact Fittings for Water Service.

I. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

1.04 QUALITY ASSURANCE:

A. All piping, fittings, and appurtenances installed by the Contractor shall be new and unused and shall be suitable for the intended purposes.

B. Each joint of pipe shall be plainly marked at the site of manufacturer to indicate the class, thickness, and/or strength.

1.05 DELIVERY, STORAGE AND HANDLING:

A. All ductile iron pipe and fittings are subject to inspection at delivery and other times as deemed necessary by the Engineer. Any pipe and/or fittings damaged during delivery shall be promptly removed from the job site.

B. Ductile-iron pipe shall be stored off the ground supported by timbers, railings or concrete supports and shall be of sufficient size to avoid contact with the ground or adjacent piping. Supports shall have chocks to prevent movement. Stacking shall be low enough to provide a safe condition, especially in neighborhoods and accessible areas.

C. Pipe and fittings shall be stored to prevent damage to the interior or exterior lining. The interior of all pipe and fittings shall be kept free of dirt and debris. Ductile iron pipe shall not be stacked higher than specified in Table 1 of AWWA C600.

D. Pipe and fittings shall be loaded and unloaded by hoists or skids to avoid sudden impact to the material. In no case shall the pipe or fittings be dropped. Slings, hooks, or pipe tongs shall be padded to avoid damage to the exterior or interior linings.

E. Gaskets for mechanical joint and push-on joint pipe and fittings shall be stored in a cool dry place out of direct sunlight. Contact with petroleum based substances is prohibited.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS:

A. American Cast Iron Pipe Company
B. U.S. Pipe
C. Others as approved by the Engineer

2.02 MATERIALS:

A. Pipe and Fittings

1. In general, ductile iron pipe for underground work shall have push-on or mechanical joints; ductile iron pipe for exposed work shall have flanged joints. Where shown on the drawings, grooved-end pipe shall be used to allow removal of valves and fittings.

2. Ductile iron pipe with push-on or mechanical joints shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, latest revision. Push-on or mechanical joints shall conform to the requirements of ANSI/AWWA C111/A21.11.

3. Pipe pressure classes and wall thicknesses shall be in accordance with bury depths and

laying conditions as specified in C150/A21.50 and C151/A21.51. Unless otherwise shown differently on the Drawings or in the Bid Schedule minimum pipe requirements are as follows:

a. Minimum pressure classes for buried ***water*** pipe shall be 350 psi for pipes ≤12 inches, 250 psi for pipes ≤ 24 inches, and 150 psi for pipe ≥ 30 inches in diameter.

a.

4. Ductile iron pipe with flanged or grooved joints shall conform to the requirements of ANSI/AWWA C115/A21.15 (including appendix) and shall have a pressure rating of 350 psi for pipes ≤ 12 inches, and a pressure rating of 250 psi for pipes ≥ 14 inches. Flanges for threading onto ductile iron pipe shall conform to the requirements of ANSI/AWWA C115/A21.15.

5. Fittings for ductile iron pipe with push-on or mechanical joints shall conform to the requirements of ANSI/AWWA C110/A21.10 and shall have a pressure rating of 350 psi for sizes ≤ 24 inches, and a pressure rating of 250 psi for sizes ≥ 30 inches. Ductile iron fittings for ductile iron pipe with push-on or mechanical joints may be compact fittings conforming to ANSI/AWWA C153/A21.53. Joints shall be mechanical joints conforming to the requirements of ANSI/AWWA C111/A21.11.

6. Fittings for flanged ductile iron pipe shall conform to the requirements of ANSI/AWWA C110/A21.10 (including appendix) and shall have a pressure rating of 250 psi. Fitting flanges shall conform to the requirements of ANSI/AWWA C110/A21.10. Gaskets for flanged joints shall be full face of first quality red rubber, 1/8-inch thick.

B. Coatings and Linings:

1. Exposed piping shall have exterior rust inhibitive primer coating compatible with finished paint.

2. All ductile iron pipe and fittings for underground installation shall receive an exterior bituminous coating of 1-mil minimum thickness.

3. All ductile iron pipe and fittings shall have an interior cement-mortar lining with asphaltic seal coat in accordance with ANSI/AWWA C104/A21.4.

4.

5. Where shown on the drawings or required by the City Engineer, ductile iron pipe and fittings situated in aggressive soils shall be polyethylene wrapped in accordance with ANSI/AWWA C105/A21.5. Wrappings shall be 8-mil low density or 4-mil high density, cross-laminated (HDCL) polyethylene film.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. The contractor shall examine the site, trench and surrounding conditions to assure proper installation of the pipe and associated fittings.

B. The contractor shall examine pipe and fittings for any scratches or abrasions to the coating or linings, or other physical damage prior to its installation.

C. Trenches shall be inspected for proper alignment and grade. Check trench bottom to ensure proper clearance from other utilities, pipelines or existing structures.

D. Any bedding required by the drawings or specifications shall be installed prior to pipe placement.

3.2 INSTALLATION:

A. Pipe installation shall be according to this section of the specification and the manufacturer's instructions and/or referenced specifications.

B. Every care shall be taken in the handling, cutting, and laying of pipe and fittings to avoid damaging the interior or exterior coating. Damaged or defective areas shall be repaired or replaced to the satisfaction of the Engineer.

C. Any ductile iron fitting showing a crack, any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the job site. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. Except as otherwise approved, all cutting shall be done with a machine having rolling wheel cutters or knives adapted to the purpose. All cut ends shall be beveled and shall be examined for possible cracks caused by cutting. Special care shall be taken to avoid excessive heat during cutting which might damage pipe lining.

D. Each section of ductile iron pipe shall be placed in the prepared trench with the full length of the barrel resting upon the pipe bed and with the pipe bell over a bell hole excavated at the proper location to accommodate the bell. No temporary supports under the pipe such as bricks, rocks, etc., shall be permitted.

E. Any pipe found defective shall be replaced. Cracked pipe may be cut as specified previously in this section if authorized by the Engineer.

F. Pipeline shall be laid with bells in direction of laying, unless it is necessary to do otherwise to make connections to existing pipe. Where pipe is to be laid on a slope, the direction of laying shall be from downstream to upstream.

G. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

H. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade as shown on the drawings.

I. Assembly of ductile iron push-on joints and mechanical joints shall be in accordance with AWWA Specifications C600, Section 3.4. The contractor shall use particular care in cleaning the socket, plain end and gasket. Mechanical joint bolts shall be tightened to the proper torques shown in Table 4, AWWA Standard C600.

J. Deflections of ductile iron pipe having mechanical joints, if authorized by the Engineer, shall not exceed the deflection limits shown in Table 6, AWWA Standard C600. All bolts and set screws shall be checked immediately before backfilling.

K. Deflections for push-on joint pipe shall conform to Table 5 of AWWA C600.

L. At times when pipe laying is not in progress, the open ends of pipe shall be closed by the use of pipe plugs or other methods approved by the Engineer to keep mud, water, and other debris out of the pipe.

M. Pipe cutting for the insertion of valves and fittings shall follow the manufacturer's recommendations. No torch cutting shall be allowed. Interior and exterior coatings shall be repaired and touched-up per manufacturer’s recommendations.

N. Trenches shall be backfilled according to Section-Trenching, Backfill and Compaction.

END OF SECTION

SECTION 02625 – DR (AWWA) PVC PRESSURE PIPE

PART 1 - GENERAL

1.01 SCOPE:

A. This section of the specifications covers the manufacturing and furnishing of DR PVC Pressure Pipe, conforming to the requirements of AWWA C900.

1.02 GENERAL:

A. All pipe and fittings shall be new and unused and in accordance with the following specifications.

B. Unless shown otherwise on the drawings or in the Bid Schedule, all DR PVC pipe shall be minimum 200 psi.

PART 2 – PRODUCTS

2.01 PIPE:

A. All DR pipe from 4 to 60 inches in diameter shall meet the requirements of AWWA C900.

B. All DR pipe shall be marked in accordance with AWWA C900 and shall include the seal of the testing laboratory that verified the suitability of the pipe material for potable water service.

PART 3 – EXECUTION

3.01 LOCATING:

A. All PVC pipe shall have location tape or wire installed in the pipe trench. Tape or wire shall be installed in the trench approximately 15 inches above the top of the pipe. Wire shall be T.W. 14 gauge solid copper conforming to specifications for annealed copper, ASTM B-3 and Underwriters Laboratories Thermoplastic Insulated Wire Standard No. 83, latest. Wire shall be Simplex BW3001 or approved equal. Pipe detector tape shall be two (2) inch wide metalized tape equal to Terratape 2" D by Griffolyn Co. or equal. No separate payment will be allowed for the locating tape or wire. Payment shall be incidental to the project.

3.02 INSTALLATION:

A. Pipe shall be bedded, laid, backfilled, and tested as shown on the drawings and as described elsewhere in these specifications.

END OF SECTION

SECTION 02660 - WATER SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This section of specifications shall cover the testing, disinfection and general installation requirements for a potable water system and/or line.

1.02 RELATED SECTIONS:

A. Section 02250 - Trenching, Backfill and Compaction
B. Section 02600 - Ductile Iron Pipe and Fittings
C. Section 15105 - Resilient Seated Gate Valves

1.03 UNIT PRICES:

A. No separate payment shall be made for flushing, testing, disinfection or other items specified in this section. All costs associated with this section shall be considered incidental to the pipe.

1.04 REFERENCES:

A. AWWA B301 AWWA Standard for Liquid Chlorine

B. AWWA C600 AWWA Standard for the Installation of Ductile Iron Water Mains and their Appurtenances.

C. AWWA C651 AWWA Standard for Disinfecting Water Mains

D. AWWA C900 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 60-inch, for Water.

1.05 SYSTEM REQUIREMENTS:

A. The Contractor shall furnish a complete and operable water system, installed according to the standards and accepted practices for waterline construction. These specifications and references specifically called for in these specifications shall be considered minimum, other incidental items may be necessary to construct a complete and operable water system.

B. The water system shall be free of leakage as defined in Section 02660, Part 3.02, Paragraph B.6 and ready for use by the Owner upon final acceptance.

1.06 REGULATORY REQUIREMENTS:

A. The Contractor shall familiarize himself with the regulatory requirements of the following governing agencies. Any deviations specified in these specifications from these agency requirements shall be promptly brought to the attention of the Engineer.

1. Alabama Department of Environmental Management
2. The Owner
3. Local Water Works Department
4. American Water Works Association

1.07 SITE CONDITIONS:

A. The Contractor shall familiarize himself with the existing conditions and special site requirements of the job.

B. Any street cuts or crossings shall be coordinated with the Owner and/or Owner's Representative. Any and all traffic control measures specified shall be incorporated by the Contractor.

C. Street cuts or crossings along or across State of Alabama Department of Transportation Right-of-Way shall follow the guidelines and requirements of the Alabama Manual on Uniform Traffic Control Devices.

D. The Contractor shall contact the City of Tuscaloosa Water Works Department concerning the use of water to be used in the flushing, pressure testing, and disinfection if project is associated with the City of Tuscaloosa Water System.

E. The Contractor shall take appropriate measures to control the disposal of water used in the testing, flushing and disinfection of water lines. The Contractor shall adequately protect streets and adjacent property from the discharge of this water. Any damages shall be borne by the Contractor. Water used for disinfection may contain high concentrations of chlorine. Any environmental damage to lakes or streams shall be the sole responsibility of the Contractor.

F. The Contractor shall coordinate with the Engineer and water works officials on the timing of all tests, flushing and disinfection of all water lines.

G. The Contractor shall coordinate with the Engineer and water works officials on all tie-ins to existing system lines and valves.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. All manufacturers of equipment used in the water line and/or system shall be experienced in the manufacture of such equipment for the water industry.

B. Equipment of like nature shall be of the same manufacturer as to maintain standardization of operation, maintenance, spare parts and manufacturer's service.

2.02 EQUIPMENT AND MATERIALS:

A. All equipment used in the water system shall be new and unused, first quality and from established manufacturers.

B. Equipment shall meet the requirements of the related sections of these specifications and associated governing agency.

2.03 TESTING EQUIPMENT:

A. The Contractor shall have on hand proper testing apparatus and associated accessories prior to beginning any tests. All fittings, piping, pressure gauges and pumps shall be in proper working order.

PART 3 - EXECUTION

3.01 THRUST BLOCKING:

A. All pressure pipe 2-inches in diameter and over shall be provided with thrust restraints. Thrust restraints shall consist of concrete thrust blocks and/or mechanical restraining rods and attachments shall be furnished at all hydrants, valves, fittings, plugs, and pipe bends.

B. The bearing area for concrete thrust blocking shall conform to the pressures required for the 24-hour test. Special blocking detailed in the Construction Plans shall supercede these requirements.

C. Concrete used in thrust blocking shall have a minimum compressive strength of 2000 psi in 28-days.

D. The concrete blocking shall be placed in such a way to contain the thrust force and still maintain accessibility of the pipe and fittings for repair. Nuts, bolts, glands, etc. shall be free of concrete. No separate payment shall be made for concrete blocking or thrust restraint.

E.

F. All restraining rods, clamps, and accessories shall be coated with a bitumastic coating before and after installation unless specified as stainless steel. The surface shall be cleaned thoroughly and the bitumastic coating applied as per manufacturer's recommendations.

3.02 TESTING:

A. Flushing:

1. Prior to beginning the pressure test, the water line shall be flushed to remove any dirt, debris and air trapped in the line. All valves shall be partially opened and closed during the flushing process. The Contractor shall flush the water line for a sufficient period of time that all air is expelled that may affect the hydrostatic pressure test.

2. All mains shall be flushed with a velocity of at least 2.5 feet per second as specified by the Alabama Department of Environmental Management.

B. Hydrostatic Pressure Test:

1. The Contractor shall coordinate with the Owner and slowly fill the section of line to be tested with water. The line shall then be pressurized to 1.5 times the working pressure

of the line, but in no case less than 150 psi. The working pressure shall be as defined by the Owner.

2. Any remaining trapped air shall be expelled at all valves and hydrants. High points in the line without access to a valve or hydrant shall be tapped and a corporation stop installed. Upon completion of the test, the corporation stop shall be left in place. A copper line shall be installed from the corporation stop to a curb stop and a meter box installed.

3. Upon complete removal of all air entrapped in the line, the line shall be again filled with water and pressurized and testing begun. Duration of the test shall be two hours for uncovered pipe and six hours for covered pipe. The test pressure shall not vary by + or - 5 psi during the duration of the test.

4. A recording pressure gauge shall be installed and pressure fluctuations recorded for the duration of the test. Test charts and records shall be available to the Engineer at the end of each test.

5. All visible leaks encountered during testing shall be repaired.

6. Leakage shall not be greater than determined by the following formula:

$$L = \frac{SDP^{1/2}}{133{,}200}$$

L = Leakage in gallons per hour
S = Length of tested pipe (ft.)
D = Diameter of pipe (in.)
P = Average test pressure during the duration of the test (P.S.I.)

7. Leakage in excess of that determined by the above formula or a pressure drop exceeding 5 psi shall be repaired at the expense of the Contractor. The leakage test shall then be repeated until the project complies with the allowable leakage.

C. Disinfection:

1. After a successful pressure test has been achieved, the waterline shall be chlorinated for the purpose of disinfection.

2. The Contractor shall use the hypochlorite continuous feed method for chlorine application as specified in AWWA Standard C651.

3. Chlorine solution shall be introduced to achieve a concentration of at least 50 mg/l in all parts of the line.

4. The chlorine solution shall be allowed to remain in the pipe for a period of not less than 24-hours at which time the chlorine concentration shall be not less than 25 mg/l.

5. All pipe and appurtenances shall be flushed with clean water until the chlorine residual is reduced to 1 mg/l or less or until compatible with the existing system. The Contractor shall not flush any lines unless the local Water Department is present.

6. Bacteriological samples shall be collected in sterile jars by the Contractor.

7. The Owner shall perform the water analysis. All costs associated with the disinfection shall be borne by the Contractor, except sample collection and analysis for one set of sampling which shall be paid for by the Owner.

8. The water line and appurtenances shall not be placed in service until an acceptable laboratory analysis has been completed.

9. If the initial disinfection fails to produce satisfactory samples, disinfection as required above shall be repeated by the Contractor at his expense until satisfactory samples have been obtained.

3.03 EXISTING UTILITY CROSSINGS:

A. Water mains paralleling existing sanitary sewers shall be positioned a minimum of 5-feet horizontally from the sewer.

B. If insufficient space is available to maintain the 5-foot separation, the bottom of the waterline shall be placed a minimum of 18-inches above the top of the sewer.

3.04 PROTECTION:

A. The Contractor shall maintain and protect the completed water line until final acceptance by the owner. Any damages to the line shall be repaired by the Contractor prior to acceptance.

END OF SECTION

SECTION 02920 - SEEDING AND MULCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This specification covers the site preparation, furnishing and applying of agricultural limestone, fertilizer, seed, and mulch, labor and equipment necessary for seeding unimproved areas encountered during construction.

1.02 RELATED SECTIONS:

A. Section 02250 - Trenching, Backfill and Compaction

1.03 UNIT PRICES:

A. Seeding and mulching shall be paid for by one of the following methods:

1. Square yard
2. Acre
3. Ton

B. The Contractor shall refer to the Bid Schedule for the appropriate unit of payment.

C. All methods of payment shall include preparing the area for seeding, including but not limited to furnishing and applying agricultural limestone, fertilizer, seeding and mulching, water as required, and all labor and equipment necessary for a complete application and maintenance.

1.04 PERFORMANCE REQUIREMENTS:

A. The acceptance of designated seeded areas will be based on verification of a satisfactory stand of grass in the season for each seed species required by the mix designated for use. If a satisfactory stand of grass is not established, the area shall be re-seeded without additional cost to the Owner. Such re-seeding shall be repeated as many times as necessary to establish a satisfactory stand of grass.

B. A satisfactory stand is defined as a cover of healthy, living plants, after true leaves are formed, of the seed species required by the mix designated for use in which gaps larger than five (5) inches square do not occur.

1.05 MAINTENANCE:

A. The Contractor shall maintain the seeded area until final acceptance of the work.

B. All costs associated with application of water during this construction and maintenance period shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Seed: All seed shall meet the requirements of these specifications and comply with the current Seed Law, Act No. 424, General Acts 1963, and rules and regulations promulgated thereunder and any revision of the Act. They shall be tested within nine months prior to use in accordance with the latest edition of Rules for Seed Testing, approved by the Association of Official Seed Analysis. The information on the seed tag of each bag of seed will be inspected and reviewed by the Engineer prior to planting and as requested. A representative sample of seed will be furnished for testing to determine the correctness of labeling. The purity and germination of hard seed shall not be less than the percentage tabulated below:

TYPE	PURITY	GERMINATION AND HARD SEED
Kentucky 31 Tall Fescue	98%	85%
Hulled Common Bermuda	97%	85%
Abruzzi Rye	98%	80%
Pensacola Bahia grass	90%	85%

No seed shall contain more than 1% weed seed. Limitations of noxious weed seeds will be as specified by rules and regulations for administration of the current State Seed Law.

B. Agricultural Limestone: The limestone shall have a neutralizing value of 90% calcium carbonate or better and meet the following gradation requirements:

Sieve Size #10, 90% by weight passing.
Sieve Size #60, 50% by weight passing.

C. Fertilizer: The fertilizer shall be a commercial grade, complying with the current State Fertilizer Laws. Fertilizer shall be of a commonly accepted analysis and conform to the following table:

PERCENT BY WEIGHT

TYPE	NITROGEN	PHOSPHORUS	POTASH
15-0-15	15		15
13-13-13	13	13	13
10-10-10	10	10	10
8-8-8	8	8	8
0-14-14	0	14	14
4-12-12	4	12	12
4-16-8	4	16	8
Cottonseed Meal	6.56		
Super Phosphate		18.0	
Ammonium Nitrate	33.5		
Ammonium Sulphate	20.5		
Nitrate of Soda	16.0		
Muriate of Potash			60.0

If the fertilizer is furnished from bulk storage, the Contractor shall furnish the supplier certification of analysis and weight. A representative sample of the fertilizer shall be furnished for chemical analysis at the discretion of the Engineer.

D. Mulch materials shall be wheat, oat, barley, or rye straw or tame hay. The materials shall be air dried and shall not be spoiled or rotted to the extent that plant stems are caked together. Mulch material containing noxious weed seeds will not be acceptable. The Contractor shall provide a method satisfactory to the Engineer for determining weight of mulch furnished.

E. Water shall be potable and free of substances that are harmful to the growth of plantings.

2.02 EQUIPMENT:

A. Spreaders shall be mechanically operated or hand operated, capable of providing a uniform application rate over the area to be covered. Broadcast spreading by hand will not be allowed.

2.03 SEEDING MIXTURES:

A. Seeding mixtures shall be as specified by the Supplementary Conditions. Seeding mixtures

shall be classed according to the time of year when seeding will take place.

B. If no seeding mixtures are specified by the Supplementary Conditions, the following mixtures and application rates shall apply:

SEED	APPLICATION RATE/ACRE
Kentucky 31 Tall Fescue	40 Pounds
Hulled Common Bermuda Grass	8 Pounds
Pensacola Bahia grass	30 Pounds
Abruzzi Rye	30 Pounds

PART 3 - EXECUTION

3.01 PREPARATION:

A. The Contractor shall dress the area to be seeded to a reasonably smooth surface, sloped to drain, and tie with surrounding contours, sidewalks, drives, etc.

B. The Contractor shall break all lumps, clods, and crusty surfaces by tillage, discing or other methods approved by the Engineer. All boulders, stumps, roots and other particles that would interfere with a mowing operation shall be removed.

3.02 APPLICATION:

A. Fertilizer shall be spread uniformly in sufficient quantity to provide at least 120 pounds of nitrogen, 120 pounds of available phosphoric acid, and 120 pounds of total potash per acre as computed from the nominal contents of fertilizing ingredients.

B. Agricultural lime shall be uniformly and evenly applied at a rate of 4,000 pounds per acre.

C. The fertilizer and lime shall be thoroughly mixed into the soil by discing, tilling or other methods approved by the Engineer.

D. The Contractor shall take precautionary measures when applying fertilizer and lime around buildings, sidewalks and drives.

E. Seed shall be uniformly and evenly spread over the area at rates specified in the supplemental conditions or in Paragraph 2.03.B of this Specification.

F. Mulch shall be applied at the rate of 1-1/2 tons per acre. Mulching shall be done within three days after seeding.

3.03 CLEANING:

A. The Contractor shall clean drives, buildings, sidewalks and other areas of all construction debris and equipment, including seed, fertilizer, lime, mulch, etc.

END OF SECTION

SECTION 11214 - VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This section includes general specifications and requirements for vertical turbine pumps. Detailed pump performance requirements are shown in the detailed pump specifications.

1.02 REFERENCES:

A. AWWA E101 AWWA Standard for Vertical Turbine Pumps

1.03 SUBMITTALS:

A. Performance Test: Submit factory certified pump performance curves for each pump to be furnished on this project.

B. Drawings: Submit detailed drawings, including but not limited to, parts lists, materials of construction dimensions, motor electrical data and installation instructions.

C. Operation and Maintenance Data: Submit complete operation and maintenance data.

D. Manufacturer's Calculations: The manufacturer shall submit complete calculations on the thrust characteristics of the pump. Manufacturer shall also submit calculations to verify the adequacy of the shafting to be supplied.

PART 2 - PRODUCTS

2.01 DESIGN:

A. Pump shall be vertical turbine, open line-shaft construction driven by vertical, hollow-shaft electric motor.

B. Pump shall be capable of continuous operation at the design conditions shown on the drawings and as outlined in the specifications.

C. Bearings shall be lubricated by pumped liquid.

D. Pumps shall be designed so that pump will not operate in continuous upthrust condition.

2.02 MANUFACTURER:

A. The following manufacturers' pumps are acceptable for this project. Material of construction may vary with each named pump. The standard construction material for each of the named manufacturers is acceptable except where the specified material is available as an optional

item then the specified material shall be furnished.

1. Integrity
2. Peerless
3. Aurora
4. Worthington

B. The manufacturer implies by submitting his pump for use on the project that the pump furnished will meet all performance requirements including but not limited to, capacity, efficiency and suitable operation at the physical arrangement shown on the drawings and specified herein.

2.03 OPERATING CONDITIONS:

A. The pump and motor unit shall meet the following operating conditions and specifications:

Item	Pump 1	Pumps 2 & 3
1. Rated pumping capacity & TDH:	150 gpm at 190 ft	300 gpm at 205 ft
2. No Flow Head Condition:	250 ft	325 ft
3. Minimum Pump Efficiency:	79.0%	84.0%
4. Rated Pump RPM:	1800	1800
5. Discharge Head Size:	4-inch	8-inch
6. Column Pipe:	Threaded Steel	Threaded Steel
7. Column Pipe Size:	4-inch	8-inch
8. Minimum Head Shaft Diameter:	1.0 inch	1.1875 inch
9. Minimum Line Shaft Diameter:	1.0 inch	1.1875 inch
10. Motor horsepower:	15 hp	30 hp
11. Motor Voltage:	230/460 V, 3-phase	230/460 V, 3-phase

2.04 Pump Bowl Assembly:

A. Pump bowl assembly shall include pump bowls, impellers, suction bell, impeller shafting and strainer.

B. Pump Bowls shall be of close-grained cast iron, flanged and bolted connection equipped with bronze wear rings.

C. Impellers shall be bronze, enclosed type.

D. Pump shaft shall be 416 stainless steel.

E. Suction bell shall be flared to minimize entrance loss. Suction bell bearing shall be fitted with bronze sand collars and shall be packed permanently with non-soluble grease.

2.05 COLUMN ASSEMBLY:

A. Column assembly shall include discharge column, line-shaft, and shaft sleeves

B. Column pipe shall be steel, maximum 5-foot column sections with flanged joints.

C. Line shafting shall be C-1045 steel. Section shall be a maximum of 5-foot long and shall be connected with SAE 1213 steel threaded couplings. The top section of lineshaft shall be 416 stainless steel.

2.06 DISCHARGE HEAD ASSEMBLY:

A. The discharge head assembly shall be of close-grained cast iron except that fabricated steel discharge heads shall be furnished if the head discharge diameter is larger than 12-inches. Integral discharge flange shall be 125 pound, type faced and drilled to ANSI Standards.

B. Stuffing box shall be of cast iron with a minimum of 5 rings of graphited asbestos packing, seal cages and cast iron packing gland.

C. Integrally cast lifting lugs shall be furnished on each head and lugs shall be capable of supporting entire weight of pump, motor, and column pipe assembly.

D. Discharge head shall be tapped for 1/2 inch NPT drain connection.

2.07 DRIVER:

A. Pump shall be driven by vertical, hollow-shaft electric motor. Horsepower, speed, size shall be as specified in detailed specifications.

B. Motor shall be equipped with non-reverse ratcheting coupling.

C. Motor shall be non-overloading over the entire pump curve.

D. Driver shall be equipped with all necessary thrust bearings.

2.08 MISCELLANEOUS:

A. Pump discharge piping shall be equipped with discharge pressure gauge and cut-off cock. Pressure range of gauge shall be 1.5 times the design operating pressure of the pump.

B. Pump shall be furnished with galvanized steel, basket type suction strainer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Handling and Storage: Contractor shall comply with all manufacturer's recommendations for

the handling and storage of the pump. Pumps installed for any lengthy period of time before operation shall be manually rotated weekly.

B. Contractor shall accomplish all pre-lubrication as recommended by the manufacturer. All lubricants shall comply with manufacturer's recommendations.

C. Pump shall be installed within horizontal and vertical tolerances as recommended by manufacturer.

D. Prior to start-up, the completed pump installation shall be inspected by a qualified representative of the manufacturer. All start-up procedures shall be supervised by the manufacturer's representative.

E. The installed pump shall operate smoothly, within vibration and sound levels as recommended by the National Hydraulics Institute.

F. The installed pump shall be run tested to verify required operating conditions are met. All operating tests shall be performed in the presence of a qualified pump manufacturer representative and the Engineer.

F. After installation all scratched and chipped areas devoid of primer shall be field primed prior to application of final painting. Final painting shall be as specified in Section 09900, Painting.

END OF SECTION

SECTION 11915 – AERATOR TOWER AND AERATION EQUIPMENT

PART 1 – GENERAL

1.0 SCOPE

This section covers the general specifications of one induced draft fiberglass square aeration tower and blower for the removal of carbon dioxide and or the oxidation of iron in the water process.

The aeration equipment shall be as manufactured by DeLoach Industries, Inc. (DI) of Sarasota, Florida, Water Equipment Services, Inc. (WES) of Sarasota, Florida, or an engineer pre-approved equal.

PART 2 – PRODUCTS

2.0 GENERAL

Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer.

2.1 Manufacturer's Qualifications

The induced draft square aerator(s) shall be supplied by a single source manufacturer with a minimum of 15 years experience in the design and fabrication of fiberglass-reinforced plastic (FRP) square aerators. The manufacturer must produce at a minimum the exterior shell of the vessel, media support plate, distribution system, and air duct assembly in-house at the manufacturing facility to insure quality and compatibility of all major components. Companies not manufacturing these key components at a minimum will not be qualified.

Each item shall be furnished and installed complete with all mechanical and electrical equipment required for proper operation, all components indicated on the drawings or specified, and all additional materials or construction required by the design of the system.

2.2 General Equipment Stipulations

The General Equipment Stipulations shall apply to all equipment furnished under this section.

2.3 Power Supply

Power supply to the equipment will be 230/460 volts, 60 Hz, 3 phase.

2.4 Anchor Bolts

All anchor bolts, nuts, and washers shall be AISI Type 316 stainless steel and shall comply with the anchor bolts and expansion anchors section and shall be sized to comply with local wind requirements and seismic design, if applicable.

2.5 Baseplates

The blower shall be mounted on a concrete base as indicated on the drawings. Baseplates shall be provided with adequate openings for grouting.

2.6 Spare Parts

The following spare parts shall be furnished:

One complete set of gaskets and seals for each blower (If applicable)
One complete set of bearings for each blower;
One complete set of gaskets for the door and hatches.

Spare parts shall be suitably packaged in accordance with the General Equipment Requirements, with labels indicating the contents of each package. Spare parts shall be delivered to the Owner as directed.

2.6 MATERIALS

Resins	An isopthalic or vinyl ester resin suitable for use with the specified product water.
Reinforcement	Glass fiber with a suitable coupling agent.
Surfacing Mat	Burlington Formed Fabrics "Nexus Veil", Nicofibers "Surmat 100", or equal.
Plastic Laminate	In conformity with the applicable governing standards.
Exposed Metal	AISI Type 316 stainless steel.
Protected Metal	Carbon steel, ASTM A36, with FRP coating.

2.7 AERATION TOWER DESIGN

One FRP square shaped, induced draft aeration tower shall be furnished to provide for the removal of carbon dioxide and or the oxidation of iron from the water process. The aeration tower shall include, but not be limited to, a square or rectangular aeration tower housing, induced draft blower complete with motor, spray nozzles, packing support plate, and packing material..

The water and induced air will flow in opposite directions, with the induced air being introduced below the packing and the water introduced above.

2.8 Design Criteria

The aeration tower shall be sized for a flow of 300 gallons per minute (gpm); an influent carbon dioxide concentration of _____ milligrams per liter (mg/L); a minimum influent pH of --_____ and an influent total dissolved solids (TDS) range of _____ to _____ mg/L. The unit shall be designed to operate on a continuous, 24 hour per day basis.

Packing shall be PVC slat trays as manufactured by DI, WES, or an engineer pre-approved equal. Packing material shall be polyethylene, polypropylene, or polyvinyl chloride. The

minimum packing height shall be 6 feet. Ceramic or metallic packing will not be acceptable. The packing material shall be supplied by the aerator manufacturer.

The aeration tower shall be designed with the following criteria:

Max. hydraulic loading 25 gpm/ft^2 of vessel cross section.
Min. air to water ratio 4:1 ft^3 air/gal water.

2.9 AERATION TOWER CONSTRUCTION

The aeration tower column shall be constructed of exterior molded FRP. The tower shall be designed to be free-standing and designed according to 2010 UBC wind requirements with a 120 mph wind load. The vessel wall shall be hand lay-up FRP material for control of thickness. The vessel shall have an exterior molded gelcoat finish with UV inhibitors. The minimum wall thickness shall be 1/4-inch. The exterior of the vessel will have FRP reinforcing rings every 33 inches on center and will be molded into the vessel wall for structural support. The internal brackets shall be FRP material and will be designed to structurally support all designed load rates. To prevent load failure, PVC or other types of plastic will not be allowed as support structures. The aerators shall be manufactured by a single source supplier specializing in FRP fabrication.

If the packing height exceeds 12 feet, the column shall have wall wiping rings installed at even intervals to prevent water from running down the inside wall of the tower.

The internal portion of the vessel will be lined with a NSF certified sealer on all portions in contact with the water. The liner shall be a Tenemec approved epoxy and shall be manufactured by Devoe, Carboline, or approved equal. The liner shall be applied as per the manufacturer's specifications. To prevent structural failure, the use of PVC liners shall not be allowed.

All bolts, fasteners, hangers, lifting lugs, etc., shall be Type 316 stainless steel.

2.9.1 Piping Connections

All piping connections to the aeration tower shall be flanged and shall conform to ANSI B16.5, Class 150 diameter and drilling.

2.9.2 Bottom Section

The bottom section of the aeration tower shall include an air inlet connection(s), an access port, water outlet, drain fitting, sight glass connections, and all other connections or components required for proper operation or by the manufacturer's design. The unit shall be designed for gravity flow of water from the bottom section of the unit.

2.9.3 Water Outlet

The water outlet shall be equipped with water seal and vortex breaker, where applicable, to preclude air from exiting with the water. The water seal and vortex breaker shall be manufactured by DI, WES, or an engineer pre-approved equal.

2.9.4 Drain

A minimum of one 4-inch drain connection shall be provided at the base of the vessel to allow complete drainage of the tower. The drain shall be PVC and will be fiberglassed into the vessel wall.

2.9.5 Media Support Plate

The tray media support system shall be fabricated from fiberglass and be designed to support the weight of packing and liquid. To prevent structural failure under full load or fouled conditions, the use of PVC or other plastic will not be allowed. The FRP aerator shall be equipped with a FRP media support system as manufactured by DI or WES. The support system shall be FRP material, and a minimum of 1/4-inch thick with. The media support plate shall be fiberglassed on all perimeters to the interior of the vessel and shall be sealed with a NSF approved resin, polyurethane, or epoxy.

If the required bed depth exceeds the packing manufacturer's recommended maximum vertical depth of packing, an intermediate packing support plate shall be installed.

2.9.6 Distribution System

An 8-inch water inlet shall connect to the liquid distributor. The liquid distributor shall be sized and installed to insure even distribution of the water across the surface of the packing at full capacity and at 60 percent of full capacity. The liquid distributor shall not impede or channel the air flow out of the top of the tower. The distributor shall be of a header lateral spray nozzle design. The nozzles shall be designed to be removed through the tower manway. Water nozzles shall be located a maximum of 12 inches above the packing and shall be designed for a maximum pressure drop of 5 pounds per square inch (psi). The distribution system shall be SCH 40 PVC, or FRP material with multiple laterals as needed. The distribution system shall be manufactured by DI or WES. The distributor will have 12 nozzles rated at 75 gpm per nozzle. The nozzles shall be Bete or Munters. To prevent short circuiting, the use of tray or weir type distributors will not be utilized.

2.9.7 Air Outlets

The air outlet shall be provided at the top of the aeration tower complete with mist eliminator and blower mounting curb. The air outlet area shall be designed to insure that the air maximum outlet-velocity does not exceed 950 cubic feet per minute (cfm) per square foot per minute.

2.9.8 Mist Eliminator

A mist eliminator shall be provided for each air outlet and shall be of a high efficiency, low pressure drop design, and shall also preclude the entrance of sunlight into the top of the tower. The mist eliminator shall be polypropylene, Munters T-271, and will be supplied by the aerator manufacturer.

2.9.9 Access Doors

The tower shall be provided with a removable FRP access door bonded to the vessel well. The door will be secured with 316 stainless steel 1/4-inch diameter bolts, and gasketed to allow for gravity loading and unloading of the slat tray media and for maintenance of the distribution lateral nozzles and packing support system.

All access port covers shall be fully gasketed with neoprene gaskets and shall be gas-tight under a positive internal operating pressure of 10 inches of water column (iwc).

2.9.10 Lifting Lugs

Suitable FRP lifting lugs shall be provided as required for handling and installation of an empty tower. The FRP lugs shall all be FRP material and will be bonded through the vessel wall or top.

2.10 AERATION TOWER BLOWERS

The aeration tower shall be furnished with a blower. The blower shall provide a minimum of 3609 cfm @ .75" static pressure.

The blower and motor shall be enclosed in a separate metal-panel enclosure with modular panels, if required, to limit noise emissions from the blower and motor to an 80 dB maximum. The fan wheel shall be of backward-inclined design, constructed of aluminum or epoxy coated carbon steel on all non-corrosive locations and will be FRP on corrosive locations.

The housing shall be of aluminum construction and shall be model ACEB as manufactured by Loren Cook Co. and be supplied by the aerator manufacturer

The fan shall be provided with a pipe coupling-type drain.

Bearings shall be grease lubricated spherical roller bearings in horizontally split cast iron pillow blocks.

2.10.1 Electric Motor

The blower motor shall comply with the General Equipment Stipulations, except as specified herein. The motor shall be horizontal, squirrel-cage induction type rated 1.5 horsepower at .75" S.P., 230/460 volts, 3 phase, 60 Hz. Each motor shall have a service factor of 1.15. The motor shall be provided with a totally enclosed fan cooled (TEFC) enclosure with lifting lugs.

PART 3 - EXECUTION

3.0 INSTALLATION

Aerator and tower system shall be installed in accordance with the manufacturer's instructions and recommendations. The aerator tower assembly shall be firmly secured to the concrete foundation and shall be firmly anchored using the recommended anchoring system. All water connections shall be watertight and free of leaks.

3.1 TESTING REQUIREMENTS

3.1.1 Blower

Blower performance shall be based on tests made in accordance with AMCA Standard 210-74. The blower manufacturer shall submit certified performance curves for the blower at rated rpm. Performance curves shall show typical ft/sec vs. static pressure and horsepower from "shutoff" to "Free Delivery". Blower shall be statically and dynamically factory balanced and given a running test with motor and drive installed.

3.1.2 Tower

The tower manufacturer shall have quality control procedures adequate to insure that all tower fabrications comply with these specifications and insure that all laminates are at least the equal of the reference samples in laminate quality. Quality control shall include a final inspection by the manufacturer and written record of this final inspection. The objective of the manufacturer's quality control and inspection procedure shall be to insure that the tower complies with the specifications after fabrication is complete, and prior to shipment of the tower to the jobsite.

The tower shall be factory hydrostatically tested for leaks by filling with water after fabrication is complete. The tower shall be checked for leaks after it has been filled for at least 1 hour. Any viable evidence of leakage shall require an investigation and correction by the manufacturer to the Owner's satisfaction. The manufacturer shall run this test prior to the time of shipping for the tower.

3.2 CLEANING AND DISINFECTING

When installation has been completed and all connections have been made, all tower surfaces, interior and exterior, shall be thoroughly cleaned and disinfected as recommended by the fabricator and so specified herein, and to the satisfaction of the Engineer. Abrasive cleaning agents shall not be used.

3.3 DRAWINGS AND DATA

Complete assemblies, foundation, and installation drawings, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted for review by the Engineer prior to fabrication of the aerator unit. The submitted data shall include full information on basic materials and written certification that the aeration tower furnished under this specification complies fully with the

structural design requirements and is being supplied by a single source manufacturer. The submittal shall include the following:

Aeration Tower
Name of manufacturer
Type and model
Inside dimensions
Overall height
Size and orientation of all connections
Packing manufacturer, type, and material
Net weight
All material types, thickness, and finishes
Details of all control devices
Pressure gauge
Mist eliminator

Blower
Name of manufacturer
Type and model
Rotative speed
Size of inlet and discharge nozzles
Net weight of blower only
Net weight with baseplate and couplings
Complete performance curves showing capacity versus efficiency and bhp
Type coupling
Complete unit overall dimensions and total weight
Detailed baseplate fabrication drawings

Motor
Name and manufacturer
Type and model
Bearing type and lubrication
Horsepower rating and service factor
Temperature rating
Full load rotative speed
Class of temperature rise
Design class
Net weight
Efficiency and power factor at rated load
Full load current
Locked rotor current, Space heater wattage, Overall dimensions

SECTION 15060 - BACKFLOW PREVENTION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This Section of Specifications covers the material and installation requirements for backflow prevention devices.

1.02 RELATED SECTIONS:

A. Section - Trenching, Backfill and Compaction
B. Section - Ductile Iron Pipe and Fittings

1.03 REFERENCES:

A. AWWA C510 and C511 AWWA Standards for Backflow Prevention Devices. Reduced Pressure Principle and Double Check Valve Types.
B. ANSI/ASSE Spec. No. 1024

1.04 SUBMITTALS:

A. The Contractor shall submit, in accordance with Section - Submittals of these specifications, product data including catalog cuts, test reports, manufacturer's installation instructions and the manufacturer's certificate of compliance with AWWA C510 and C511.

1.05 QUALITY ASSURANCE:

A. Backflow prevention devices shall be tested by a laboratory recognized as having expertise in testing backflow prevention devices as required in Section 1.3 of AWWA C510 and C511 Specifications. The laboratory shall be acceptable to the Owner.

1.06 DELIVERY, STORAGE AND HANDLING:

A. The manufacturer shall prepare each backflow prevention device for shipment so that no damage will occur during shipment.

B. All backflow preventers shall be complete in every respect and completely drained with all openings closed prior to shipment.

C. Upon receipt, the Contractor shall thoroughly examine backflow preventers for damage during shipment and store them in a clean, dry and safe area.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Because of the threat of electrolysis, when differing metals are used, insulation and/or electrolytically similar metals shall be used throughout the construction.

C. Commercial Double Check Valve and Reduced Pressure Zone Backflow Preventers:

1. Valve bodies, covers, spools and spacers shall be ASTM B61, Bronze, or ASTM A126, Class B, Gray Iron.

2. Clapper and Poppett Facing Rings shall be molded synthetic rubber with a shore durometer hardness of 35 to 45.

3. Relief Valve Facing Rings shall be molded synthetic rubber with a shore durometer hardness of 60 to 70.

4. Swing Pin and Guide Stems shall be ASTM B139, Grade A, C or D Phosphor Bronze or ASTM A 276, Type 304, Stainless Steel.

5. Springs shall be ASTM A313 Steel or ASTM B159 Phosphor Bronze.

6. Diaphragms shall be synthetic rubber with a cotton or rayon insert conforming to Federal Specification HHP-151B.

7. Seat Rings and Valve Seats shall be ASTM B61 Bronze or ASTM A276, Type 304, Stainless Steel.

2.02 MANUFACTURED UNIT:

A. Backflow Preventers shall be manufactured as a unit capable of operating at a supply pressure of 150 psi and a temperature of 140-degrees F.

B. Residential dual check valve backflow preventers shall meet or exceed ANSI/ASSE Standard 1024.

C. Double check valve and reduced pressure zone backflow preventers shall meet or exceed AWWA C510 and C511 Specifications.

2.03 FABRICATION:

A. All foundry and machine work shall be first class, free of injurious defects and conform to the manufacturer's tolerances. Bronze units shall be certified as lead free.

B. Flange joints shall be faced true and machined at right angles to their respective axes. Threaded joints shall be concentric and accurately cut free of burrs.

C. All joints shall be tested as watertight when subjected to the design pressure.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. The Contractor shall examine all backflow preventers for damage prior to installation.

3.02 INSTALLATION:

A. All backflow preventers shall be installed on the consumer side of the meter.

B.

C. Backflow preventers greater than 2" in diameter, shall be installed as shown on the Drawings.

D. All backflow preventers shall be installed with no leakage around any joint.

E. Backflow preventers greater than 2" in diameter shall have blocking castings under them so that their weight is not supported by the adjacent piping.

END OF SECTION

SECTION 15090 - VALVE BOXES AND VAULTS

PART 1 - GENERAL

1.01 SUMMARY

A. This section of specifications covers materials, installation and other incidentals pertaining to valve boxes and vaults installed around valves for water service.

1.02 RELATED SECTIONS

A. Section – Trenching, Backfill, and Compaction
B. Section – Water System
C. Section – Resilient Seated Gate Valves

1.03 PAYMENT:

A. Valve Boxes:

1. Valve boxes shall be considered incidental to the installation of the associated valve and no separate payment will be allowed for valve boxes.

2. In the case of large valves installed with bypasses, both valve boxes shall be considered incidental to the installation of the valve.

B. Vaults:

1. If shown on the Bid Schedule as a pay item, payment for vaults shall be per each or as defined on the Bid Schedule. If no bid item is shown for vaults on the Bid Schedule, the vaults will be considered incidental to the project and no separate payment will be allowed.

1.04 SUBMITTALS

A. Valve Boxes:

1. The Contractor shall submit product data including catalog cuts, manufacturer's data and other incidental information on valve boxes.

B. Vaults:

1. The Contractor shall submit shop drawings to be approved prior to the manufacture of all lids and covers to be installed over vaults.

1.05 QUALITY ASSURANCE

A. Valve Boxes:

1. Valve boxes shall be cast by a foundry with at least five years experience in the casting of valve boxes and covers.

B. Vaults:

1. Vaults shall be built according to detail drawings specified in the plans. The Contractor shall construct the vaults in a neat and workmanlike manner.

2. Vault covers shall be fabricated according to the detail drawings and shop drawings approved by the Engineer. Vault covers shall be fabricated in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Clow Corporation, Model No. F-2452
B. Opelika Foundry
C. Acheson Foundry
D. Mueller Company, Model No. E-2702

2.02 MATERIALS

A. Valve Boxes and Covers:

1. Valve boxes and covers shall be of cast-iron manufactured as a unit with all associated extensions and bases.

2. Valve boxes shall be 2 piece, screw type, with a 5-1/4" shaft.

3. Valve box risers shall be 6" PVC.

4. Covers for valve boxes on potable water lines shall have the word “WATER” cast onto the cover. Covers for sewage valves, sludge valves, and non-potable water valves shall have the word “SEWER” cast onto the cover. Covers for natural or manufactured gas valves shall have the word “GAS” cast onto the cover.

B. Vaults:

1. Vaults shall be constructed of reinforced concrete as shown on the Drawings.

2. Vault covers shall be constructed of steel plate and angles as detailed on the drawings or of manufactured supplied items as specified on the Drawings. Steel shall be A 36, shop primed, and painted. Color shall be selected by the Owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Valve boxes shall be inspected prior to installation for any defects, cracks, and that all necessary parts are on hand.

3.02 INSTALLATION

A. Valve Boxes:

1. Valve boxes shall be installed plumb, centered over the operating nut on a firm and compacted base and carefully and thoroughly backfilled.

2. Valve boxes shall be installed so as to not induce stress to the valve.

3. Valve boxes shall be installed with the top no more than 1/2-inch above finished grade. Valve boxes shall be installed with the top of the box flush with finished paving.

3.03 PROTECTION

A. Valve boxes and vaults shall be protected from damage until final acceptance of the work.

B. Any valve box or vault damaged prior to final acceptance of the work shall be removed and replaced with all costs borne by the Contractor.

END OF SECTION

SECTION 15105 – RESILIENT SEATED GATE VALVES

PART 1 - GENERAL

1.01 SUMMARY:

A. This section covers materials, installation and performance criteria for resilient seated gate valves to be used in water and sewer service.

1.02 RELATED SECTIONS:

A. Section 02250 - Trenching, Backfill and Compaction
B. Section 02660 - Water System

1.03 UNIT PRICES:

A. Resilient Seated Gate Valves shall be paid for per each, if a bid item is denoted in the Bid Schedule. If a specific bid item is not denoted in the Bid Schedule, payment for resilient seated gate valves shall be included in the stated lump sum bid amount. Payment, in either case, shall be based on a complete, installed and operable valve with valve box and concrete support considered incidental to the installation of gate valves. This payment shall include compensation for all appurtenances, materials, labor, etc. necessary to complete the work.

1.04 REFERENCES:

A. AWWA C509 American Water Works Standards for Resilient Seated Gate Valves for Water Supply Service.

B. AWWA C515 American Water Works Standards for Reduced-Wall Resilient Seated Gate Valves for Water Supply Service.

C. AWWA C550 American Water Works Standards for Protective Epoxy Interior Coatings for Valves and Hydrants.

D. AWWA C600 American Water Works Association Standard for Installation of Ductile-Iron Water Main and their appurtenances.

1.05 SUBMITTALS:

A. The Contractor shall furnish detail assembly drawings, specifications, catalog data and dimensions, and 5 sets of operating instructions for all gate valves.

1.06 QUALITY ASSURANCE:

A. The Contractor shall supply to the engineer an affidavit from the manufacturer that all gate valves 2-inches and larger conform to AWWA C509 or AWWA C515 and that all tests specified therein have been performed and all test requirements have been met.

B. The Contractor shall supply to the Engineer an affidavit of compliance from the

manufacturer that all gate valves smaller than 2-inches conform to Federal Specification WW-V-54 and have a pressure rating of 200 psi minimum.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Packing and Shipping:

1. Markings shall be cast on the bonnet or body of each valve conforming to AWWA C509 or AWWA C515.
2. Valves shall be packaged for shipment to avoid damage during shipping and handling. All gate valves shall be completely drained and closed prior to shipment.

B. Acceptance at Site:

1. Gate valves shall be thoroughly checked at the site prior to unloading. Any valves found defective or damaged during shipment will be rejected.
2. The Contractor shall provide adequate lifting equipment to unload large valves. In no case should valves be dropped.
3. Chains, hoists or other lifting devices should not be fastened around bypasses, yokes, gearing, motors, stems or handwheels. Valves shall not be lifted by the stem.

C. Storage and Protection:

1. Valves should be stored in a closed position and protected from rain, dirt and debris by covering or storing indoors. In freezing weather the Contractor shall take steps to assure valves do not freeze.
2. Rubber gaskets for joints shall be stored in a cool, dry place out of direct sunlight. Avoid contact between petroleum based substances and rubber gaskets.
3. Gate valves shall be stored such that the resilient coating on the interior of each valve is not exposed to direct sunlight for extended periods of time. In addition, each valve shall be stored to avoid exposing the epoxy interior coating to nicks and abrasions.

1.08 SCHEDULING:

A. The Contractor shall schedule deliveries of gate valves to assure the proper materials are on hand prior to the installation of the work.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS:

A. American Darling Valve Company.
B. Clow.
C. Mueller.
D. M & H

2.02 EQUIPMENT:

A. Gate valves 2-inches through 12-inches:

1. Gate valves shall conform to AWWA C509 or AWWA C515.
2. Gate valves shall be iron-bodied, resilient wedge unless otherwise noted.
3. Operating nuts shall be 2-inch in size and operate counter clockwise to open the valve.
4. Gate valves shall be mechanical joint if buried and flange joint if located inside or attached to structures. Retainer glands shall be used with mechanical joints unless otherwise specified.
5. Valves shall be non-rising stem type, unless specifically denoted otherwise.
6. The interior coating shall be fusion bonded epoxy conforming to AWWA C550.
7. The iron valve body shall be hydrostatically tested to 500 psig and the completed valve shall be bubble tight to 250 psig.

B. Gate Valves smaller than 2-inches:

1. Gate valves shall be bronze, Stockham B103, or equal.
2. Gate valves shall conform to Federal Specification WW-V-54, Class 150.
3. Gate valves to have non-rising stem - inside screw type solid wedge disc.
4. Gate valve body, bonnet and disc to be bronze, meeting ASTM Specifications B-62.
5. Packing nut and stuffing box to be bronze, meeting ASTM Specifications B-584.
6. Packing gland to be brass.
7. Handwheel to be malleable iron, meeting ASTM Specifications A-197.
8. Handwheel nut to be steel.
9. Full port opening - disc to recess completely into bonnet.
10. Packing to be non-asbestos Kevlar with Teflon.

C. Gate Valves 14-inch through 48-inch:

1. In general, resilient seated gate valves, 14-inch through 48-inch shall conform to the requirements for resilient seated gate valves 2-inches through 12-inches except for the requirements denoted below:

    a. Unless denoted otherwise the operating stem shall be horizontal.
    b. The operating nut shall operate a fully enclosed gear drive to operate the valve stem and open and close the valve.
    c. Gears shall be smooth running, accurately cut and made from ASTM A26 Grade U-60-30 steel.
    d. Gear ratios shall conform to Table 7 of AWWA C500.
    e. Fully enclosed gear cases designed for underground use shall be provided.
    f. The iron body shall be hydrostatically tested to 400 psig and the completed valve assembly shall be bubble tight at 200 psig.

2. Bypasses shall be provided for all valves 24-inches and larger.

    a. Bypass sizing shall conform to Table 8 of AWWA C500.
    b. Valves used for bypasses shall be non-rising stem gate valves of the same size as specified in Table 8 above.
    c. Valves used for bypass shall conform to these specifications.
    d. Piping used in bypasses shall be ductile-iron, mechanical joint conforming to Section 02600, Ductile Iron Pipe and Fittings.

2.03 FABRICATION:

A. Valves shall be fabricated and assembled to be well fitted and to operate smoothly.

B. Parts shall be designed and manufactured to be interchangeable between manufacturers of the same type and size.

C. Castings shall be sound and free from defects.

2.04 SOURCE QUALITY CONTROL:

A. Each gate valve shall be subjected to an operation test and hydrostatic test at the place of manufacture.

B. The Contractor shall supply to the Engineer an affidavit of compliance as specified in 1.06.A and B of these specifications.

C. Operation and hydrostatic testing shall conform to applicable section of AWWA C509 or AWWA C515.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Prior to the installation of the gate valve, the valve should be examined and inspected for compliance with these specifications and proper operation.

B. Valves that fail to comply with these specifications or operate properly shall be removed from the jobsite without compensation.

C. All gate valves shall be operated through one complete cycle by the Contractor in the presence of the Engineer to verify proper operation.

3.02 PREPARATION:

A. Prior to installation of the valve, the Contractor shall prepare the area for valve installation by supporting the associated piping to align the valve.

B The Contractor shall determine that proper materials are on hand for a complete valve installation.

C. The Contractor shall review the manufacturer's installation instructions to ascertain that no unusual installation procedures are required. Should the Contractor find any unusual procedures, he shall promptly report them to the Engineer.

3.03 INSTALLATION:

A. All gate valves installed underground shall be installed in a closed position.

B. Gate valves shall be installed on a firm footing and temporarily supported until a permanent

support can be poured. Pipe ends should be supported to minimize bending to the valve end connections.

C. A valve box or vault shall be installed around all gate valves. The Contractor shall refer to the drawings for any special vaults to be constructed. If no special vault is specified a valve box shall be installed.

D. Valve boxes and vaults shall be installed to avoid traffic and other surface loading being transmitted to the valve.

E. Valve boxes shall be centered over the operating nut with the top flush with the surrounding finished elevations.

F. Large valves installed with bypasses shall have a second valve box installed, centered over the smaller bypass valve operating nut.

G. Valves installed in deep trenches with the operating nut located six feet below the finished surface shall have stem risers provided for operation with a six-foot key.

H. Gate valves installed above ground shall be supported to avoid excessive stress and bending to the valve end connections.

3.04 FIELD QUALITY CONTROL:

A. After installation, but prior to pressure testing, all bolts shall be checked with a torque wrench for proper torque.

B. Gate valves shall be left uncovered during hydrostatic testing to check for leaks unless test pressures are great enough to cause unstable conditions at the valve.

C. Gate valves shall not be tested at pressures greater than twice the rated working pressure of the valve.

3.05 RECORDS:

A. The Contractor shall sufficiently mark all gate valve locations and record the size, make, date of installation, and number of turns necessary to open. The Contractor shall furnish the Engineer with 3 copies of such records.

3.06 PROTECTION:

A. The Contractor shall protect all gate valves from damage until final acceptance of the work.

END OF SECTION

SECTION 15127
TURBINE TYPE WATER METERS

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the Work necessary to furnish and install turbine type flow meters as shown on the Drawings.

1.2 GENERAL

A. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

1.3 SUBMITTALS DURING CONSTRUCTION

A. Submittals during construction shall be made in accordance with Section 01300, SUBMITTALS in Division 1, GENERAL REQUIREMENTS.

PART 2 PRODUCTS

2.1 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

2.2 TURBINE WATER METER

A. Water meter shall be flanged tube, turbine type with lead-free bronze case, integral straightening vanes, thermoplastic rotor, and stainless steel shaft. All meters shall conform to AWWA Standard C701.

B. The meter register shall be permanently sealed and magnetically driven and shall include sweep hand and 8-digit register with 100-gallon/sweep hand revolution. Meter size shall be as indicated on the Drawings, and meters shall be rated for 150 psi.

C. Turbine water meter shall be supplied with a strainer such that meter and strainer are supplied as a complete assembly form the meter manufacturer.

D. Turbine water meters shall be Recordall Turbo Series, or equal.

PART 3 EXECUTION

6.1 GENERAL

A. All equipment in this Section shall be installed carefully to avoid damage to the instruments and in accordance with the manufacturer's instructions. Pressure gauges and thermometers shall be placed and positioned so that they are easily readable from the operating floor.

B. The CONTRACTOR shall furnish such additional incidental materials and labor as required for proper mounting. Install measuring and metering devices plumb or level, as applicable, and attach securely to mounting brackets with suitable fasteners. Units installed in-line shall be made up with the gaskets or thread lubricant specified for the adjacent piping.

END OF SECTION

JRA PROJECT NO. 222217
Sullivan WTP Rehabilitation - Phase 2
Gordo Water, Gas and Sewer Board
CLIENT JOB NO. NS.17174
BASED ON CLIENT TEMPLATE: "Neel-Schaffer.docx"
PRINTED ON: June 9, 2023

ELECTRICAL SPECIFICATION INDEX:

6/9/2023

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. General Conditions:

1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

B. General Requirements:

1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
4. The Owner shall be provided access to all software to include copies of software for all systems provided under this division of the specifications. Software shall be password protected where applicable.
5. Only qualified electrical sub-contractors will be allowed to submit proposals for this project. In order to be considered qualified, contractor shall have completed a minimum of five (5) projects of similar type/scope and equal or greater magnitude and complexity within the last ten (10) years. Sub-contractors without qualifications will be rejected. If desired, potential electrical sub-contractors may submit qualification evidence for review and pre-bid approval a minimum of ten (10) days prior to bid. Previous projects used to meet this experience requirement must have included similar (or greater) scopes of work for each of the following areas:

    a. Power Systems.
    b. Control Systems.
    c. Instrumentation Systems.

6. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed

1.02 GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)

A. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.

B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto. Dispose of salvageable materials as directed by the Engineer. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.

C. Furnish and install complete power, telephone and other electrical services as shown on drawings and/or specified herein.

D. Pay all electrical utility company service charges (if any) in connection therewith, including permanent meter deposit. Meter deposits will be refunded to Contractor at time of Owner's acceptance.

E. Furnish and install complete power distribution system as shown on drawings and/or specified herein.

F. Furnish and install a complete Power Generation and Automatic Transfer Switch System as shown on drawings and/or specified herein.

G. Furnish and install complete reduced voltage soft starters and associated devices for motors as shown on drawings and/or specified herein.

H. Furnish and install disconnect switches for motors as shown on drawings and/or specified herein.

I. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.

J. Install and connect electrical equipment mentioned in Division 16 Specifications or noted in drawings, whether furnished by electrical contractor or by others.

1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.

K. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.

L. Furnish and install all electrical items shown on drawings and/or herein specified, unless

shown or specified otherwise.

M. Furnish and install complete controls, instrumentation & auxiliary systems as shown on drawings and/or specified herein.

N. Furnish and install a complete Surge Protection System as shown on drawings and/or specified herein.

O. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.

P. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.

Q. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.

R. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

PART 2 - PRODUCTS

2.01 APPROVED MATERIALS AND DEVICES

A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or trademark. All equipment/systems subject to approval of Engineer before installation. All like items and associated equipment/systems shall be of one manufacturer.

B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 16 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.

C. To ensure commonality of spare parts, it is required that the electrical contractor provide the same brand for all circuit breakers, starters, power equipment, etc. provided under the following divisions of these specifications:

1. SECTION 16055: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
2. SECTION 16410: SAFETY SWITCHES AND FUSES
3. SECTION 16442: LIGHTING PANELBOARDS
4. SECTION 16443: MOTOR CONTROL CENTERS
5. SECTION 16461: DRY TYPE TRANSFORMERS

2.02 SUBMITTALS

A. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.

B. Submit to Engineer ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.

C. Submit to Engineer promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:

1. SECTION 16055: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
2. SECTION 16231: GENERATOR SETS
3. SECTION 16268: REDUCED VOLTAGE SOFT STARTERS, 600VAC
4. SECTION 16289: SURGE PROTECTIVE DEVICES
5. SECTION 16410: SAFETY SWITCHES AND FUSES
6. SECTION 16415: AUTOMATIC TRANSFER SWITCHES
7. SECTION 16442: LIGHTING PANELBOARDS
8. SECTION 16443: MOTOR CONTROL CENTERS
9. SECTION 16461: DRY TYPE TRANSFORMERS
10. SECTION 16480: MANUFACTURED CONTROL PANELS
11. SECTION 16511: LIGHTING MATERIALS AND METHODS
12. SECTION 16850: ELECTRICAL HEAT TRACING SYSTEMS
13. SECTION 16905: INSTRUMENTATION
14. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
15. ALL ELECTRICAL AND TELECOMMUNICATION EQUIPMENT LAYOUTS - Submittals shall include ¼” = 1’-0” CAD drawings (hand drawn sketches will not be accepted) of each electrical room, IT room, electrical equipment stand, generator area, or any other similar area with electrical equipment. Drawings shall indicate all panelboards, transformers, switchboards, generators, equipment racks, control panels, HVAC equipment, etc. that are located in each electrical/IT area. Layouts shall show that each piece of electrical equipment has the clearances, working space and dedicated equipment space required by applicable codes. No conduits to equipment within these areas shall be installed until submittals have been provided and returned without exception by the design team.
16. ALL CONTROL ITEMS & SYSTEMS

D. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Engineer. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Engineer will be for general conformance with contract documents. The contractor shall

be fully responsible for correctness of all submitted dimensions, details, quantities and locations.

E. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Engineer without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.

F. Any required resubmittal will be reviewed by the Engineer for conformance with previously issued comments only. The contractor shall be responsible for verifying that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.

G. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Engineer. All material proposed for substitution is subject to the approval of the Engineer and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.

H. Samples of material shall be furnished where required by drawings or Division 16 Specification, or as requested by the Engineer on items proposed as substitutes.

I. Submit to Engineer a certificate of final inspection from local inspection department.

PART 3 - EXECUTION

3.01 SITE VISIT

A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

3.02 CLEARANCE WITH UTILITIES

A. It shall be the responsibility of this Contractor, prior to bid, to reaffirm with the utility companies involved, that the locations, arrangement (and with power company voltage, phase, and metering required) and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, the Contract price shall include any additional cost necessary to meet those requirements without extra cost to Owner after a contract is entered into.

B. On many projects the utility company may levy charges due to locations, size or type service involved. The Contractor shall be responsible for these charges (including permanent meter deposit), unless such charges are not available prior to bid and Contractor so documents as described below. The meter deposit will be refunded to the contractor at time of Owner’s acceptance.

C. Should above cost not be available, prior to bid, Contractor must submit a letter signed by a responsible utility company person so stating with his bid and in turn must be submitted by Prime Contractor with his bid to Owner. The cost will then be deleted from the Contract and become responsibility of the Owner.

D. Arrange with utility companies for such services as shown or herein specified and installation of meter where shown. Furnish with shop drawings a signed document from utility companies describing the location and type of services to be furnished and any requirements they may have. This document shall be signed for each utility company by a person responsible for granting such service.

3.03 WORKMANSHIP

A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.

B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.

C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.

D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.

E. Keep site clean of accumulation of cartons, trash and debris.

3.04 SAFETY

A. The contractor is solely responsible for all job safety. Engineer assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably insure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

3.05 CONTRACT DOCUMENTS

A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.

B. Contract documents consist only of the hardcopy documents issued by the Prime Engineer. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).

C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:

1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
2. Agree to pay the electrical engineer a fee of $50.00 per drawing, up to a maximum of $400 per transfer, payable upon receipt of the files.
3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.

D. Take finish dimensions at job in preference to scaled dimensions.

E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Engineer.

3.06 UNDERGROUND UTILITY/EQUIPMENT COORDINATION

A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Engineer immediately if any conflict is found.

3.07 EQUIPMENT STORAGE

A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Engineer.

3.08 EXCAVATION, CUTTING AND PATCHING

A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Engineer's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Engineer before cutting into any structural members.

B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

3.09 PENETRATIONS

A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 16 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal

section.

B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.

C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

3.10 INSTALLATION OF EQUIPMENT - GENERAL

A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.

B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.

C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted stainless steel disconnect switches shall be mounted to stainless steel unistrut frames.

D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.

E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.

F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

3.11 MOTORS, STARTERS AND CONTROLS

A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.

B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.

C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit by the electrician.

3.12 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.

B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

3.13 LUG/TERMINAL RATINGS

A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.

B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

3.14 EQUIPMENT FAULT CURRENT RATINGS

A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

3.15 OUTLET LOCATION

A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to insure correct installation.

3.16 IDENTIFICATION

A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.

B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.

C. See Specification Section 16075 for additional requirements.

3.17 GROUNDING

A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.18 PAINTING

A. Refer to Painting/Finishing specifications for requirements regarding field painting of

exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

3.19 ACCEPTANCE TESTING

A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Engineer. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.

B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:

1. SECTION 16231: GENERATOR SETS
2. SECTION 16268: REDUCED VOLTAGE SOFT STARTERS, 600VAC
3. SECTION 16415: AUTOMATIC TRANSFER SWITCHES
4. SECTION 16850: ELECTRICAL HEAT TRACING SYSTEMS
5. SECTION 16905: INSTRUMENTATION

3.20 OPERATION AND MAINTENANCE DATA

A. One set of marked “AS BUILT” drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner’s representative.

3.21 GUARANTY-WARRANTY

A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:

1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 16050

SECTION 16055 - POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES

PART 1 - **GENERAL**

1.01 SCOPE OF WORK

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Power Distribution System Electrical Studies.

PART 2 - **PRODUCTS**

2.01 GENERAL REQUIREMENTS

A. Short Circuit Studies, Protective Devices Evaluation Studies, Protective Device Coordination Studies and Arc Flash Hazard Studies shall be performed by the same entity, which shall be a Professional Engineer registered in the state where the equipment will be installed. The studies shall be per the requirements set forth in the latest edition of NFPA 70E-Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.

B. The studies shall be submitted to the Engineer prior to shipment of any electrical distribution equipment.

C. The studies shall include all portions of all electrical systems affected by the project (including any existing systems/equipment) from the utility service to any existing equipment at the facility (including all existing equipment fed from the same service point as any new equipment) and to all new equipment installed under this contract. All induction motors 50 HP or below and fed from the same bus may be grouped together. All induction motors greater than 50 HP shall be included individually with associated starters and feeder impedance. See individual study sections below for additional scope requirements.

D. The studies shall be performed using the latest revision of the SKM Systems Analysis Power*Tools for Windows (PTW) or EasyPower software program.

E. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.

F. The contractor shall be responsible for collecting data on any existing or proposed electrical equipment, devices, conductors, etc. as required to prepare the study, and shall supply pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the studies to be completed prior to shipment of equipment.

G. The Power Distribution System Electrical Studies shall be performed by Square 'D' or Cutler Hammer; or a third-party vendor if specifically approved by the engineer prior to

preparation of the studies.

H. The proposed vendor shall have completed a minimum of five (5) equivalent Arc-Flash Hazard Studies in the past three (3) years.

2.02 SHORT CIRCUIT STUDY

A. The Short Circuit Study shall be performed with aid of a computer program. The study input data shall include the power company's short circuit contribution, resistance and reactive components of the branch impedances, X/R ratios, base quantities selected, and other source impedances.

B. Short circuit momentary duty values and interrupting duty shall be calculated on each individual basis with the assumption that there is a three-phase bolted short circuit at the respective switchgear bus, switchboard, low voltage motor control center, distribution panelboard, and other significant locations throughout the system.

C. The short circuit tabulation shall include symmetrical and asymmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contributions from each connected branch, including motor back EMF current contributions shall be listed with its respective X/R ratio.

2.03 PROTECTIVE DEVICE EVALUATION STUDY

A. The Protective Device Evaluation Study shall be performed to determine the adequacy of circuit breakers, switches, transfer switches, and fuses by tabulating and comparing the short circuit rating of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied.

B. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Engineer's attention.

2.04 PROTECTIVE DEVICE COORDINATION STUDY

A. The Protective Device Coordination Study shall be performed to provide the necessary calculation and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. The objective of the study is to obtain optimum protective and coordination performance from these devices.

B. The coordination study shall show the best coordination attainable for all breakers down through the largest breaker at each piece of distribution equipment. Coordination study shall demonstrate selective coordination where required by applicable codes or contract documents.

C. Phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices. Where ground fault protection is used, coordination of the

ground fault protection with the first downstream overcurrent phase protection device shall be demonstrated.

D. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves be maintained.

2.05 ARC-FLASH HAZARD STUDY

A. The Arc-Flash Hazard Study shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.

B. The Arc-Flash Hazard Study shall be performed in conjunction with a short-circuit Study and a time-current coordination Study.

C. The Arc-Flash Hazard Study shall be performed for the following equipment:

1. All Distribution Equipment – This includes but is not limited to the following:

    a. Switchgear
    b. Switchboards
    c. Motor Control Center
    d. All Lighting and Power Panelboards
    e. Fused Disconnect Switches rated greater than 100A

2. Separately enclosed devices fed from protection device rated greater than100A - This includes but is not limited to the following:

    a. Control Panels
    b. VFD’s
    c. RVSS

D. A generic Arc-Flash label shall be applied to other electrical equipment that has not been included in the study. This includes but is not limited to the following equipment:

1. Non-fused Disconnect Switches
2. Fused Disconnect Switches rated 100A or less
3. Transformers
4. Control Panels, VFD’s, RVSS, etc. rated 100A or less

E. Where a main protective device is provided, the study shall be performed on the line side and load side of the main. The worst-case result shall be used for the study result and label.

F. The Study shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

G. Where incident energies are calculated to fall within the high marginal region of a given

Hazard/Risk Category Level, the Hazard/Risk Category Level shall be increased one level.

H. The Arc-Flash Hazard Study shall be performed in compliance with the latest IEEE Standard 1584, the IEEE Guide for Performing Arc-Flash Calculations. Where IEEE 1584 does not have a method for performing the required arc-flash calculations (such as for single phase equipment), calculations shall be performed and system shall be modeled using modules/methods as recommended by the arc flash software supplier (for example, using SKM Unbalanced/Single Phase Studies module for modeling single phase systems).

I. Equipment labels to identify AFIE and appropriate Hazard/Risk Category in compliance with NFPA 70E and ANSI Z535.4 (latest version of these requirements) shall be provided to the Electrical Contractor. The Electrical Contractor shall affix the labels to the distribution equipment devices as directed by the equipment manufacturer. These labels shall, at a minimum, include the following:

1. WARNING label.
2. Hazard/Risk Category.
3. Arc Flash Boundary Distance.
4. Incident Energy (in cal/cm2) at Working Distance.
5. Shock Hazard Voltage.
6. Limited Approach Boundary Distance.
7. Restricted Approach Boundary Distance.
8. Prohibited Approach Boundary Distance.
9. Equipment Name.
10. Name of Firm who prepared the Study.
11. Project Number of the Firm who prepared the Study.
12. Date that the Study was prepared.
13. Method for calculating analysis data.
14. Statement to read: “Any system modification, adjustment of protective device settings, or failure to properly maintain equipment will invalidate this label” (or equivalent).

PART 3 - **EXECUTION**

3.01 SUBMITTAL REQUIREMENTS

A. The results of the studies shall be summarized in a final report. The report shall include the following sections:

1. General:

a. Description, purpose, basis and scope of the studies
b. Single line diagram of the portion of the power system which is included within the scope of the work. The single line diagram shall fit on one sheet of paper (size as required) unless approved otherwise by engineer. The following information shall be shown on the single line diagram:

1) Device Name
2) Branch Fault Currents with directional indicators
3) General Location (for busses only)
4) Other basic component information such as cable type, cable length, breaker rating, buss short circuit rating, transformer voltages, transformer size, fuse size, etc..

2. Short Circuit Study:

a. Tabulation of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.

3. Protective Device Evaluation/Coordination Study:

a. Protective devices time versus current coordination curves**,** tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
b. Fault current calculations including definitions of terms and a guide for interpretation of computer printout.
c. Documentation from utility company on their letterhead showing their anticipated values of available short circuit currents X/R ratios and protective devices with which the power distribution system will coordinate.
d. Time-current characteristics of the respective protective devices shall be plotted on log-log paper. Plots shall be printed in color with a dedicated color and pattern for each curve for clear identification.
e. Plots shall include complete titles, respective single line diagrams and legends, and associated power company's relay or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breakers trip curves and fuses.
f. The coordination plots shall indicate the type of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents.
g. The coordination plots for phase and ground protective devices shall be provided on a system basis.
h. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.

4. Arc-Flash Hazard Study:

a. Tabulation of device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
b. Recommendations for reducing AFIE levels and enhancing worker safety.

B. Furnish all labor, materials, calculations, electrical equipment, technical data and

incidentals required to provide a complete short circuit study, coordination study and arc flash hazard study of protective devices, busses, etc. from the utility service to any existing equipment at the facility and all new equipment installed under this contract.

C. The study shall comply with the following applicable provisions and recommendations of the latest revisions of the following: ANSI C37.5, IEEE Standard No. 399, and IEEE Standard No. 141.

D. Submit calculations and results of the short circuit, protective device evaluation and coordination and arc flash hazard studies prior to submitting shop drawings for new equipment. Contractor shall verify that all proposed equipment is properly rated per the short circuit and protective device evaluation portions of the study prior to releasing equipment for manufacturing.

E. Submit a copy of a sample typical arc flash label layout (meeting requirements outlined above) that will be used for the project.

F. Submit final electronic copies of all SKM program files/models/input data/etc. used to perform the study to the owner with final close-out documents. These files shall be complete as required to allow future users to recreate the study.

3.02 INSTALLATION

A. Contractor shall adjust all breaker settings as recommended by the coordination study prior to energizing equipment.

B. Contractor shall affix arc flash hazard notification labels (as determined by the results of this study) to each piece of distribution equipment prior to energization of equipment. A generic arc-flash warning label shall be affixed to any electrical equipment not included in the analysis as outlined above.

C. Where short circuit rating of equipment is dependent on setting of upstream overcurrent device, provide and install label for equipment indicating the required settings of the associated device.

END OF SECTION 16055

SECTION 16060 - GROUNDING

PART 1 - GENERAL

1.01 GENERAL

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:

1. Service Equipment.
2. Transformers.
3. Non-current carrying conductive surfaces of equipment.
4. Metal Buildings.
5. Structures.
6. Other Equipment.

1.02 GENERAL REQUIREMENTS

A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to insure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.

B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall insure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.

B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be “jumpered” by an appropriate bonding conductor.

C. Supplemental grounding system conductors shall be bare, softdrawn, stranded, single conductor copper wire, and generally sized as follows (unless shown otherwise on plans):

1. Switchgear, motor control centers, and power transformer #4/0 minimum or as shown on plans.
2. Power panels, #2/0.
3. Control panels and consoles, #4.
4. Process Motors, #1/0.

5. Building Columns, #4/0.
6. Light Poles, #2.
7. Telephone Backboard & Cabinet ground busses, #2.

2.02 GROUNDING ELECTRODES

A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

2.03 CONNECTIONS

A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.

B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).

C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.

D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.

E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

2.04 MANUFACTURERS

A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.

B. Lugs shall be as manufactured by Square “D”, Burndy, or T and B.

C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.

D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.

E. Split post grounding shall be as manufactured by Burndy or T and B.

PART 3 - EXECUTION

3.01 MAIN SERVICE GROUND

A. The main service grounding electrode system shall consist of the following items bonded together by the grounding electrode conductor:

1. The main underground cold water pipe (metal).
2. The metal frame of the building.
3. Driven ground rods. Ground rods shall be embedded at the lowest point in the building and below the permanent moisture level. Ground rods shall be spaced a minimum of ten (10) feet apart and connected in parallel until resistance to ground does not exceed five (5) ohms.

B. The grounding electrode system shall be connected to the grounded conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor not smaller than that shown in Table 250.66 of the N.E.C. The main service equipment grounding conductor shall be connected to the grounding conductor on the supply side of the service disconnecting means in accordance with Table 250.122 of the N.E.C. for the ampere rating of the service entrance equipment. Where in a service entrance switchboard, the equipment grounding conductor shall not be less than 25% of the main bus rating. These connections shall be made inside the service entrance equipment enclosure.

3.02 TRANSFORMER GROUNDS

A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

3.03 EXPOSED NON-CURRENT-CARRYING METAL PARTS

A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.

B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8”.

C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground. Connections from the supplemental grounding system (when specified) shall be made directly to the motor frame. Additionally, utilization equipment connected to the motor (pump, fan, mixer, etc.) shall be bonded to the motor with flexible braid-type bonding strap to ensure equalization of ground potentials.

D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together

and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible "jumpers" shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections or rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.

E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.

F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.

G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.

H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

3.04 ACCEPTANCE DOCUMENTATION AND TESTING

A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.

B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.

C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 ("Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System"). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Engineer prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 16060

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Wire and cable identification.

B. Pullbox & Junction Box Identification

C. Electrical distribution & utilization equipment identification.

D. Emergency and Standby Power receptacle identification.

E. Instrument and control device identification.

F. Raceway identification.

PART 2 - PRODUCTS

2.01 WIRE AND CABLE IDENTIFICATION

A. Intermediate Locations:

1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.

B. Circuit/Cable Termination Locations:

1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

2.02 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

2.03 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as follows:

1. Emergency System source: Red engraved lettering to read “EMERGENCY”.
2. Legally-Required or Optional Standby Generator source:

a. If only part of facility is fed with generator backup: Black engraved lettering to read "FED FROM GENERATOR".
b. If entire facility is fed with generator backup: No "….GENERATOR…" label required.

2.04 INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

A. Instruments and control device labels shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment or the adjacent, visible mounting surface with silicone adhesive or stainless steel wire ties.

2.05 RACEWAY IDENTIFICATION

A. Raceway labels shall be white thermal transfer marker plates permanently affixed to the associated raceway with stainless steel wire ties, with two wire ties (one on either end of marker plate to provide a flush installation) where possible. Labels shall be Panduit #M300X series or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Engineer for review and comment prior to installation.

B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.

C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).

D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

3.02 WIRE AND CABLE IDENTIFICATION

A. General:

1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.

B. Intermediate Locations:

1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:

    a. Wireways
    b. Pullboxes/Junction boxes larger than 4-11/16”
    c. Pullboxes/Junction boxes through 4-11/16” where wires and cables are not easily identifiable via the color coding and box labeling
    d. Vaults & Manholes
    e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
    f. Other similar intermediate locations.

2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:

    a. From where the circuit originates (including panel designation and circuit number):

        1) Ex: “FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)”

    b. To where the circuit extends (using the common name of the equipment):

        1) Ex: “TO: RTU-6 (ON ROOF)”

    c. The purpose of the circuit:

        1) Ex: “POWER”

    d. The set number (If parallel power feeds are used).

        1) Ex: “SET NO. 3 OF 4”

C. Circuit/Cable Termination Locations:

1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.

D. Refer to Specification Section 16120 for all color-coding requirements of wires and cables.

3.03 PULLBOX & JUNCTION BOX IDENTIFICATION

A. Concealed pullboxes/junction boxes:

1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: “RP-1A Cir. 1, 2 & 3”). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.

B. Exposed pullboxes/junction boxes:

1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled “Power”, “Telecommunications”, “Fire Alarm” or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.

C. Where pullboxes/junction boxes are named on contract documents (Ex:”PULLBOX #3”), an engraved nameplate shall be installed on the front surface of the box to identify the name.

3.04 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. General:

1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.

B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:

1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:

a. Ex: First Line: “NAME: RP-A”, Second Line: “120/208V-3Ø-4W”, Third Line: “FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)”

2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.

C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.)::

1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade type switches and toggle-type switches) and on

utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):

a. Ex: First Line: “RTU-6”, Second Line: “FED FROM: PP-A CIR. 5”

2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: “WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH”.
3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: “WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER”.

D. Emergency Systems:

1. A sign shall be placed at the service entrance equipment (and at any remote shunt trip operators, or similar, for service equipment) indicating the type and location of on-site emergency power sources (such as generators, central battery systems, etc.) per NEC requirements.
2. All boxes and enclosures (including transfer switches, generators, power panels, junction boxes, pullboxes, etc.) dedicated for emergency circuits shall be permanently marked with white-on-red engraved nameplates so they will be readily identified as a component of an emergency circuit or system.
3. Where an Essential Electrical System (EES) is installed, all enclosures, raceways and equipment that are components of the EES shall be readily identified as such. Raceway shall be identified at intervals not exceeding 25 ft.

E. Services:

1. All Service Equipment:

a. Engraved nameplates identifying maximum available fault current, including date the fault current calculation was performed, in accordance with NEC article 110.24.

1) Ex: First Line: “AVAILABLE FAULT CURRENT: 16,154 AMPS”, Second Line: “DATE CALCULATED: JULY 8, 2013”

b. All service entrance equipment shall be clearly labeled as being service entrance rated.

2. Where a building or structure is supplied by more than one service (or any combination of branch circuits, feeders and services), a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders & branch circuits supplying that building or structure and the area served by each, per NEC requirements.

F. Generators:

1. Generators shall be labeled with engraved nameplates identifying name of equipment.

3.05 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as described above.

3.06 INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

A. New Instruments and control devices (whether furnished by contractor or not) shall be labeled with black-on-white engraved nameplates permanently affixed to the equipment or to the adjacent, readily-visible mounting surface with silicone adhesive or stainless steel wire ties.

1. Instruments and process control devices (float switches, etc.) shall be labeled with instrument name and, where available, instrument ID number.
2. Pushbutton stations shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all pushbutton stations.
3. Thermostats and other similar HVAC control devices installed in process areas shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all thermostats and other similar HVAC control devices.

3.07 RACEWAY IDENTIFICATION

A. Each exposed raceway shall be labeled at the point where it becomes concealed, such as where it enters a concrete floor slab, a concrete wall, the ground, etc.

B. Each raceway entering in-grade or on-grade pullboxes/junction boxes, where the conduits are only visible inside the box, shall be labeled within the box at the point where the raceway becomes concealed.

C. Raceway nameplates shall identify:

1. The location of the other end of the raceway (“TO MCC-1” or similar). If the other end of the raceway is at an intermediate, named pullbox (“INSTRUMENTATION PULLBOX #4” or similar), that pullbox name shall be labeled rather than the endpoint of the circuitry.

3.08 OTHER IDENTIFICATION

A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 16075

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Conduits
2. Conduit Fittings
3. Couplings & Connectors
4. Bushings
5. Raceway Hardware, Conduit Clamps & Supports
6. Watertight Entrance Seal Devices

PART 2 - PRODUCTS

2.01 CONDUITS

A. PVC-Coated Rigid Steel:

1. The PVC coated rigid metal conduit must be UL Listed. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
2. The PVC-coated rigid metal conduit shall be ETL PVC-001 listed.
3. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
4. Form 8 Condulets®, 3/4" through 2" diameters, shall have a tongue-in-groove “V-Seal" gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available.
5. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
6. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
7. Form 8 Condulets® shall be supplied with plastic encapsulated stainless steel cover screws.
8. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
9. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30deg.F (-1deg.C).

10. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
11. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
12. Independent certified test results shall be available to confirm coating adhesion per ETL PVC-001 standards under the following conditions:

    a. Conduit immersed in boiling water with a minimum mean time to adhesion failure of 200 hours. ASTM D870)
    b. Conduit and condulet exposure to 150deg F (65deg C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D11513.
    c. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
    d. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
    e. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1.
    f. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

13. Water tight flex connectors used in areas where PVC coated metal conduit is utilized shall be PVC coated also.
14. Shall be as manufactured by Perma-Cote, Plastibond, Korkap, Ocal or Okote.

B. Rigid Galvanized Steel and I.M.C.:

1. Shall be galvanized outside and inside by hot dipping.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

C. E.M.T.:

1. Shall be Electro-Galvanized.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

D. Rigid Aluminum:

1. Shall be manufactured of 6063 Alloy, T-1 temper.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

E. Schedule 40 and 80 PVC:

1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.

2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.

F. HDPE Innerduct

1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.
2. Shall be corrugated unless noted otherwise.
3. Shall be manufactured by Carlon, Ipex or equal.

G. Flexible Metallic Conduit:

1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.

H. Liquidtight Flexible Metallic Conduit:

1. Shall be galvanized steel-core sealtite, code approved for grounding.
2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

2.02 FITTINGS, COUPLINGS & CONNECTORS

A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Raco, Efcor, or Appleton or equal.

B. All fittings, couplings and connectors (including, but not limited to, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.) used in areas where PVC-Coated Rigid conduit is used shall also be PVC-coated.

C. All fittings, couplings and connectors (including, but not limited to, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.) installed in other wet, exterior or process areas where PVC-coated conduit systems are not required, shall be aluminum or stainless steel type. Standard steel fittings will not be acceptable.

D. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.

E. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Raco. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Raco, Midwest or equal. E.M.T. fittings, couplings and connectors located

within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.

F. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.

G. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.

H. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Raco, Midwest or equal.

I. All LB unilets sizes 1 ¼" or larger shall have rollers.

J. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds, Pyle-National, Russell & Stoll or equal.

2.03 BUSHINGS

A. All non-grounding rigid bushings 1-1/4" and larger shall be the insulating type (O-Z/Gedney type "BB" or equal by T&B, Midwest Electric or Penn Union).

B. All non-grounding rigid bushings 1" and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type "B" or equal by T&B, Midwest Electric or Penn Union.

C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type "BLG" or equal by T&B, Midwest Electric or Penn Union.

2.04 HARDWARE, CONDUIT CLAMPS AND SUPPORTS

A. All hardware such as expansion shields, machine screws, toggle bolts, "U" or "J" bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).

B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

C. Supports in exterior, process, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.

E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

2.05 WATERTIGHT ENTRANCE SEAL DEVICES

A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).

B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Minimum Diameter: 3/4-inch.

B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:

1. Exterior, Exposed: Rigid Aluminum unless otherwise noted.
2. Exterior, Used for Instrumentation Circuits: See Below.
3. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See “transition” items below for additional requirements. Conduits shall be left exposed until after Engineer’s observation.
4. Interior, Exposed:

    a. Hazardous Locations: Rigid Aluminum .
    b. Wet Locations (including, but not limited to, Pump Rooms, Areas with exposed piping, Dewatering Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Aluminum .
    c. Dry Locations: Rigid Aluminum.
    d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.

5. Interior, Concealed:

    a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2” of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to

exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See "transition" items below for additional requirements.

b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): PVC-Coated Rigid Steel

c. Other Raceways: E.M.T.

6. Raceways used for Instrumentation Circuits:

a. Typical Dry or Wet Locations: Rigid Aluminum .

b. Underground or Locations Embedded inside Poured Concrete: PVC-Coated Rigid Steel.

c. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): PVC-Coated Rigid Steel.

7. Terminations at motors, transformers and other equipment which has moving or vibrating parts:

a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.

b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).

8. Terminations at instruments:

a. Liquidtight Flexible Metallic Conduit (shall generally not exceed 12 inches in length) with watertight fittings.

9. Terminations at fixtures mounted in grid-type ceilings:

a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).

10. Transition from underground or concrete-encased to exposed:

a. Convert PVC to PVC-Coated Rigid Steel utilizing PVC-Coated Rigid Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6" above floor level, and shall be installed at uniform heights.

3.02 RACEWAY INSTALLATION

A. General:

1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
3. Where any run of rigid aluminum conduit (including bends) exceeds 50' in length, an approved conduit expansion fitting shall be installed (beginning at center of run) at intervals not to exceed 50' on center.
4. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
5. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
6. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.
7. All PVC joints shall be made as follows:

    a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
    b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
    c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.

8. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.
9. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
10. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
11. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings.
12. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) or urethane paint (for PVC-Coated Rigid Steel) as recommended by conduit manufacturer .
13. Installation of PVC coated conduit systems shall be performed in strict accordance with the manufacturer's installation instructions. Damage to PVC coated conduit coating shall be touched up with patching compound as directed by manufacturer. To assure correct installation, the installer shall be certified by the manufacturer to install coated conduit.

B. Routing/Locating:

1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.

3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3" from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. No conduit for instrumentation shall be run closer than 12 inches to parallel power conduits.
8. A minimum of 12" of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
9. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:

1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.
2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
3. All bends in raceways containing multi-conductor power cables (such as shielded VFD cables) shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
4. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
5. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:

1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be

rigidly supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.

2. Rigid Aluminum Conduits shall be supported at intervals not to exceed 5' on center.
3. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
4. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.
5. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
6. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:

1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. In wet, exterior or process areas, conduits shall NOT enter tops of enclosures. All conduits shall enter enclosures from bottom, left or right sides of the enclosure (utilizing rain-tight Meyers hubs as indicated above).
3. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
4. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
5. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
6. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
7. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.
8. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
9. Conduit ends shall be carefully plugged during construction.
10. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.
2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.

    a. Where the elevation of the raceway penetration (into the structure) is no more than 15’ below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22’ of continuous water head pressure), or pre-approved equal, shall be used.
    b. Where the elevation of the raceway penetration (into the structure) is between 15’ and 75’ below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical Seals (rated to hold back up to 36psi or 83’ of continuous water head pressure), or pre-approved equal, shall be used.
    c. Where the elevation of the raceway penetration (into the structure) is more than 75’ below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.

6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices. In special applications (such as to instruments, etc.,), where cabling rated for exposed application is provided, contractor may propose short air gaps (approximately 6” or less) between the end of the conduit system and the equipment/device cable entry (to be made with cable gland connectors) to prevent water in conduit system from entering equipment/devices in lieu of drained junction boxes.
7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:

a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.

8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).
9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.

G. Exterior Electrical Ductbanks:

1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:

a. A minimum of 3" of concrete shall encase each side of all ductbanks.
b. A minimum of 1 ½" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 16110

SECTION 16116 - AUXILIARY SYSTEM CABLES, 0-50V

PART 1 - GENERAL

1.01 DESCRIPTION

A. Cables rated for 0V-50V application

PART 2 - PRODUCTS

2.01 GENERAL

A. Unless specified otherwise, all cables within the scope of this specification section shall:

1. Be rated for exposed cable tray installation.
2. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
3. Be UL-rated for the proposed application.
4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
5. Utilize copper conductors.
6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

2.02 INSTRUMENTATION CABLING

A. In addition to above requirements, and unless specified otherwise, Instrumentation cabling shall:

1. Be #16AWG minimum.
2. Be rated for 300V.
3. Have aluminum foil shielding.
4. Have stranded, twisted conductors.
5. Have PVC insulation/jacket with ripcord.
6. Be manufactured by Belden, AlphaWire or General Cable.

2.03 CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:

1. Be rated for 600V.
2. Be industrial grade.
3. Have stranded conductors.
4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
5. Be manufactured by Belden, AlphaWire or General Cable.

2.04 CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:

1. Be rated for 300V.
2. Be shielded if so recommended by the system supplier/integrator.
3. Have twisted conductors.
4. Have plenum-rated insulation/jacket with ripcord.
5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

2.05 NETWORK CABLING

A. Furnish and install all Ethernet, Fiber Optic and Backbone Copper Telephone cabling in accordance with all BICSI requirements and in accordance with other applicable specification sections.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Routing:

1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:

a. Cabling is plenum-rated, multi-conductor.
b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5’-0” on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30” on center.
d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.

2. End bushings shall be provided on both ends of all raceway terminations.
3. No splices shall be pulled into conduit.
4. No cabling shall be pulled until conduit is cleaned of all foreign matter.

B. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
2. For cabling not installed in conduit:

    a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

3. For cabling installed within conduit from endpoint to endpoint:

    a. Fire/smoke barrier penetrations shall sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.

4. For cabling installed within cable trays:

    a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:

        1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.
        2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

C. Excess Cabling:

1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.

D. Terminations:

1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
2. Cabling shall be neatly formed, bundled and tied at all terminations.

3.02 SPLICES/CONNECTIONS/TERMINATIONS:

A. Network Cabling:

1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

B. Control Cabling:

1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.

C. Shielded cabling:

1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.
2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

3.03 LABELING

A. Refer to Specification Section 16075 for all labeling requirements.

END OF SECTION 16116

SECTION 16120 - POWER CONDUCTORS AND CABLES 51V-600V

PART 1 - GENERAL

1.01 DESCRIPTION

A. Power Wires and Cables

B. Low Voltage Wires and Cables

PART 2 - PRODUCTS

2.01 POWER WIRES AND CABLES - 600 VOLT

A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.

B. General Application (see below for exceptions):

1. At or Below Grade (including within slab-on-grade):

a. #8 or larger conductors:

1) XHHW or RHH/RHW/USE stranded (in conduit).

b. #10 or smaller conductors for circuits terminating at motors:

1) THHN/THWN or XHHW stranded (in conduit).

c. #10 or smaller conductors (excluding circuits terminating at motors):

1) THHN/THWN or XHHW solid (in conduit).

2. Above Grade:

a. #8 or larger conductors:

1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).

b. #10 or smaller conductors for circuits terminating at motors:

1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).

c. #10 or smaller conductors (excluding circuits terminating at motors):

1) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).

3. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Amercable, Aetna or approved equal.

C. VFD Cabling

1. Wiring/Cabling installed between each VFD (Variable Frequency Drive) and the associated motor shall be multi-conductor shielded VFD power cable with the following characteristics:

   a. Multi-conductor cable with three (3) power conductors and three (3) ground conductors
   b. Soft annealed flexible stranded copper conductors.
   c. 1kV cross-linked polyolefin insulation (to resist the potential reflected voltages experienced in 600VAC VFD applications).
   d. Metallic shielded providing 100% shield coverage
   e. Oil, abrasion, chemical & sunlight resistant thermosetting compound outer jacket.
   f. Flexible TC-ER rated, UL listed for use in cable trays.
   g. Equal to AmerCable #37-108VFD cable.

D. Emergency Feeder Wiring

1. Where specifically required by NEC articles 700, 701, or other similar sections, feeder-circuit wiring for emergency systems and legally-required standby systems shall be a listed electrical circuit protective system consisting of 2-hour fire-rated, mineral insulated, copper-sheathed wiring cable (Pyrotenax System 1850 or equal).

E. Class 1 Control Cabling (120VAC Control Circuits, Etc.)

1. Unless specified otherwise, Class 1 control cabling shall:

   a. Be rated for exposed cable tray installation.
   b. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
   c. Be UL-rated for the proposed application.
   d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
   e. Utilize copper conductors.
   f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.

g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
i. Be rated for 600V.
j. Be industrial grade.
k. Have stranded conductors.
l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.

2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.

F. Fixture Wiring

1. Conductor Types:

a. Type TFFN or XFF.

2. Minimum Sizes:

a. For fixtures up to 300 watts: #16.
b. For fixtures over 300 watts up to 1500 watts: #14.
c. For fixtures over 1500 watts: as required.
d. Conductors to concrete pour fixtures: #12.

3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

2.02 WIRE CONNECTIONS:

A. All connector types:

1. Shall be properly rated for the proposed application by UL and per the manufacturer.

B. At Motor Connections (within motor terminal boxes):

1. On Unshielded Wire:

a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.
b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or Ilsco.

2. On Shielded Power Wire:

a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.

C. Other Dry locations:

1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
2. On Wire #10 and smaller: shall be made with one of the following:

a. Ideal Wing Nuts or equal by 3M .
b. Ideal Push-In Wire Connectors (for #12 and smaller only).

D. Other Wet/Damp locations:

1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by Ilsco, Burndy or T&B.
2. On Wire #10 and smaller: shall be made with one of the following:

a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. All wires and cables shall be installed in conduit unless specifically noted otherwise.

B. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.

C. No splices shall be pulled into conduit.

D. No conductor shall be pulled until conduit is cleaned of all foreign matter.

E. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.

F. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.

G. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

H. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

3.02 POWER WIRE AND CABLE INSTALLATION:

A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.

B. Multi-wire lighting branches shall be used as indicated.

C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).

D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).

E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.

F. In installing overhead main power services, a minimum of 5’-0” of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

3.03 WIRE CONNECTIONS

A. See Part 2 above for material types.

B. Aluminum Wire Connections:

1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).

C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.

D. All electrical connections and terminals shall be tightened according to manufacturer’s published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer’s torque values are not provided, those specified in UL 486A & 486B shall be used.

E. All connections and connector types shall be installed in strict compliance with all requirements of the connector manufacturer.

F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at

equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

3.04 SHIELDED CABLE INSTALLATION

A. Shielded VFD (power) cables:

1. The braided shields and internal grounding conductors of shielded VFD (power) cables shall be grounded at BOTH ends (at VFD and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.
2. Contractor shall coordinate the necessary size of conduit with the outer diameter of the proposed cable type to verify that the raceway loading does not exceed NEC requirements prior to rough-in of the conduit system.

B. Shielded instrumentation (low voltage) cables:

1. The outer foil of shielded instrumentation cables shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.

3.05 LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:

1. Cabling shall be plenum-rated, multi-conductor.
2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5’-0” on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30” on center.
4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.06 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.07 LABELING AND COLOR CODING OF WIRE AND CABLE

A. Refer to Specification Section 16075 for all labeling requirements.

B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI-LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

D. Control Conductors: Shall be color coded by use of colored “tracers”. No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.08 TESTING

A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification (“ATS”) standard shall be replaced by the contractor at the contractor’s

expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 16120

SECTION 16130 - OUTLET BOXES, JUNCTION BOXES, WIREWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Outlet and Junction Boxes

B. Pull Boxes

C. Wireways

PART 2 - PRODUCTS

2.01 OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")

A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.

B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.

C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.

2.02 JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")

A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.

B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.

C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.

D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.

E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.

F. Pre-cast Polymer Concrete Below-Grade Hand Holes & Pull Boxes:

1. Enclosures, boxes and cover are required to be UL Listed and conform to all test provisions of ANSI/SCTE 77 "Specifications For Underground Enclosure

Integrity" for Tier 15 applications (15,000lb design load and 22,500lb test load) unless noted otherwise.

2. All covers shall have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level shall be embossed on the top surface.
3. Cover shall be bolt-down include factory-labeling to read "Electric", "Communications" or other as directed.
4. Hardware shall be stainless steel.
5. Shall be Quazite PG/LG Style or approved equal.

G. Galvanized Cast Iron Below-Grade Pull Boxes:

1. Enclosures, boxes and cover are required to conform to AASHTO H-20 requirements for deliberate vehicular traffic applications unless noted otherwise.
2. Cover shall be checkered, bolt-down include factory-labeling to read "Electric", "Communications" or other as directed.
3. Hardware shall be stainless steel.
4. Shall be furnished with grounding kit.
5. Shall be O-Z/Gedney Type YR or approved equal.

H. Above-Grade Padmounted Low Profile Pull Boxes:

1. Construction:

    a. 12Ga. stainless steel base with 12Ga aluminum top with brushed finish, and structural bracing as required.
    b. Continuous base frame with open bottom and eight (8) ½" x 1" slots for securing box to concrete pad below and a center support member.
    c. Two (2) full-size swing-open lids with full-length, stainless steel continuous hinges, lifting handles, key-locking provisions and provisions for latching lids in open position (with stainless steel chain or approved equal).
    d. Guides on lid and base frame as required to insure proper closing of box and to provide increased security.
    e. Aluminum or stainless steel barrier between power & instrumentation areas within box if box is used for both power and instrumentation wiring.
    f. Other stainless steel hardware as required.

2. Minimum Dimensions:

    a. Power: 40 inches square x 18 inches high.
    b. Instrumentation: 24 inches square x 18 inches high.

3. Manufacturer:

    a. Electrical Enclosure Mfg. (Pell City, AL).
    b. Ebox (Pelham, AL).
    c. Approved Equal.

I. Above-Grade Padmounted Transclosure Pull Boxes:

1. Construction:

a. 12Ga.aluminum with brushed finish.
b. Continuous top and bottom support frames with open bottom and slots as required for securing box to concrete pad below and a center support member.
c. Roof with 1” crest on each unit and gutters between each unit.
d. Vents (with screens) on top and bottom around perimeter of box.
e. Full-size swing-out doors on two (2) opposing sides with weld-on barrel hinges (minimum of two per door) and key-locking “L”-handles with roller rods.
f. Stainless steel barrier between power & instrumentation areas within box if box is used for both power and instrumentation wiring.
g. Other stainless steel hardware as required.

2. Minimum Dimensions:

a. Power: 42 inches square x 42 inches high.
b. Instrumentation: 42 inches square x 42 inches high.

3. Manufacturer:

a. Electrical Enclosure Mfg. (Pell City, AL).
b. Ebox (Pelham, AL).
c. Gilbert Electrical Systems
d. Approved Equal.

PART 3 - EXECUTION

3.01 APPLICATION

A. General

1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16”)

a. Sheet metal boxes shall be used on concealed work in ceiling or walls.

2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed.
3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.

5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.

C. Junction & Pull Boxes (larger than 4-11/16")

1. For all below grade exterior use and elsewhere as shown:

   a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).
   b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).

2. All boxes installed exposed in exterior or wet areas shall be stainless steel (NEMA 4X).
3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
5. Padmounted Pull Boxes shall be installed as shown on Plans or as required by project conditions. Transclosure-style Padmounted boxes shall be installed wherever required by the quantities and sizes of conductors. Contractor shall submit all Padmounted Pull Box types prior to ordering for engineer's review and comment.
6. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
7. All others shall be oil tight JIC box not less than 16 gauge.

3.02 INSTALLATION

A. General

1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 16075 for identification requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16")

1. Boxes shall be provided with approved 3/8" fixture studs were required.

2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

C. Junction & Pull Boxes (larger than 4-11/16")

1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

D. Wireways and/or wall-mounted equipment

1. Mount each wireway to channels of the same metal type as the wireway.
2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Wiring Devices

B. Plates

C. Finishes

PART 2 - PRODUCTS

2.01 WIRING DEVICES AND PLATES

A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.

D. Each wiring device shall have a plate (see “Finishes” section below for specific requirements).

2.02 FINISHES

A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.

1. Exceptions:

a. Emergency wiring devices shall be red.
b. Isolated ground wiring devices shall be orange.

B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.

C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless

steel, brass, etc.) in area installed.

D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.

E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.

F. See “Electrical Identification” specification section for coverplate labeling requirements.

PART 3 - EXECUTION

3.01 GENERAL MOUNTING

A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.

B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.

C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.

D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.

E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.

1. Receptacles and telephone outlets in offices and other finished areas: 1’-6” to the center of the box.
2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4’-0” to the center of the box.
3. Receptacles over counters: As Noted
4. Switches, general: 4’-0” to the top of the box.
5. Fire Alarm Pull Stations: 4’-0” to the top of the box.
6. Fire Alarm Audio/Visual Devices: As shown on fire alarm shop drawings (Entire lens shall be above 80” and below 96” per NFPA 72).
7. Push-button, etc., general: 4’-0” to the top of the box.
8. Other device types: verify with engineer prior to rough-in.

END OF SECTION 16140

SECTION 16231 - GENERATOR SETS

PART 1 - GENERAL

1.01 SCOPE

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.02 CODES AND STANDARDS

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of the latest editions of the following standards/codes where applicable:

1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
2. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
3. International Building Codes.
4. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
5. NFPA99 – Essential Electrical Systems for Health Care Facilities.
6. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the latest editions of the following standards where applicable:

1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
2. UL142 – Sub-base Tanks
3. UL1236 – Battery Chargers
4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

C. The generator set and supplied accessories shall meet all applicable Environmental

Protection Agency (EPA) TIER Emission Level or Emission Certification requirements and any local requirements in effect at the time the generator set is ordered (for the proposed location of the generator).

D. The control system for the generator set shall comply with the following requirements.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
4. FCC Part 15, Subpart B.
5. IEC8528 part 4. Control Systems for Generator Sets
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
8. UL1236 –Battery Chargers.

E. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 ACCEPTABLE MANUFACTURERS

A. Caterpillar

B. Cummins/Onan

C. Generac

D. Kohler

PART 2 - PRODUCTS

2.01 GENERATOR SET

A. Ratings

1. The generator set assembly (including both the motor/engine assembly and the generator assembly) shall operate at 1800 rpm, and the generator shall produce a 60 Hz waveform.
2. Voltage and phase ratings shall be as shown on plans.
3. Minimum kW rating (and associated alternator sizing) shall be the greater of the following:

a. Minimum kW rating listed on plans.

b. Ratings required to provide skVA as follows (shall be documented with reports in submittals using generator sizing software described in Part 3 below):

1) If so listed on plans, the step loads fed by the generator at voltage/frequency dip criteria specified.
2) If so listed on plans, the skVA rating specified.
3) If neither of the above are listed on plans, generator shall be sized to accommodate a block load of 100% of the Total Demand Load listed on plans, with a maximum voltage dip of 20% and a maximum frequency dip of 10%.

4. kVA rating shall be 1.25 times the kW rating (based on .8 PF).
5. Unless shown otherwise on plans, the generator set shall be rated based on the following site conditions:

a. Altitude of project site.
b. Ambient temperatures up to 120 degrees F.

6. The generator set rating shall be based on emergency/standby service unless noted otherwise.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.
3. The engine-generator set shall be capable of accepting a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Minimum motor starting capability shall be as shown on plans. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified skVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 20% unless shown otherwise on plans.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. The engine-generator set shall be rated for the seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.
3. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept compression terminations of the number and size as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required overcurrent protection located at panelboard(s) external to the generator set unless shown otherwise on plans. Where a load center or panelboard is shown within the generator enclosure on the plans, this load center/panelboard shall be furnished with the generator and shall comply with the applicable panelboard and identification sections of this specification.
3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.02 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be natural gas fueled, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set. For dual fuel systems, changeover from primary to secondary fuel shall be automatic.
2. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed and operating in various isochronous or parallel states. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

3. Skid-mounted radiator and cooling system rated for full load operation in 120 degrees F (49 degrees C) ambient as measured at the generator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H_2O restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.
4. Electric starter(s) capable of three complete cranking cycles without overheating.
5. Positive displacement, mechanical, full pressure, lubrication oil pump.
6. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
7. Replaceable dry element air cleaner with restriction indicator.
8. Flexible fuel lines.
9. Engine mounted battery charging alternator and solid-state voltage regulator.
10. Block heater

    a. Engine mounted, thermostatically controlled, block heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
    b. The block heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The block heater installation shall be specifically designed to provide proper venting of the system. The block heaters shall be installed using quick disconnect couplers to isolate the heaters for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
    c. The block heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the block heater system.
    d. The block heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification. If the heater quantities or wattage ratings are different than shown on plans, contractor shall be responsible for providing the properly-rated circuits (with circuit breakers) as required to the heater(s).

11. Provide vibration isolators, spring & pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
12. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables

and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.

13. Provide critical-grade exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
14. A UL listed/CSA certified voltage regulated battery charger shall be provided for each engine-generator set. The charger shall be located at the generator unless shown otherwise on plans. Output amperage, Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

    a. Loss of AC power - red light
    b. Low battery voltage - red light
    c. High battery voltage - red light
    d. Power ON - green light and N.O. relay contact

15. Provide 120 volt battery warmer with automatically controlled thermostat.

2.03 AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.04 GENERATOR SET CONTROL

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this

specification.

B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. The generator set mounted control shall include the following features and functions:

1. Control Switches

a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
b. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
c. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
d. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
e. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

a. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output.
b. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

c. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

3. Generator Set Alarm and Status Display.

a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright exterior day lighting conditions.

b. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. Conditions required to be annunciated shall include:

1) low oil pressure (warning)
2) low oil pressure (shutdown)
3) oil pressure sender failure (warning)
4) low coolant temperature (warning)
5) high coolant temperature (warning)
6) high coolant temperature (shutdown)
7) high oil temperature (warning)
8) engine temperature sender failure (warning)
9) low coolant level (warning or shutdown - selectable)
10) fail to crank (shutdown)
11) fail to start/overcrank (shutdown)
12) overspeed (shutdown)
13) low DC voltage (warning)
14) high DC voltage (warning)
15) weak battery (warning)
16) high AC voltage (shutdown)
17) low AC voltage (shutdown)
18) under frequency (shutdown)
19) over current (warning)
20) over current (shutdown)
21) short circuit (shutdown)
22) ground fault (warning) (if genset breaker is rated 1000A or greater)
23) over load (warning)
24) Genset circuit breaker tripped (warning)
25) emergency stop (shutdown)

4. Engine Status Monitoring.

a. The following information shall be available from an analog status panel on the generator set control :

1) engine oil pressure (psi or kPA)
2) engine coolant temperature (degrees F or C)
3) battery voltage (DC volts)

5. Engine Control Functions.

a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

6. Alternator Control Functions:

a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, with local indication of setting level.
b. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The

protective functions provided shall be in compliance to the requirements of NFPA70 article 445. This protection may be provided using a microprocessor-based programmable relay system designed to protect the alternator system from damage, or using programmable electronic-trip LSI breaker(s), programmed/set by the generator supplier to ensure full protection of the alternator system.

d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

f. When required by National Electrical Code or indicated on project drawings, the control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

7. Other Control Functions

a. The generator set shall communicate with the Automatic Transfer Switch via hardwired control connections as required.

b. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.

c. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is out of acceptable limits. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

8. Dry Contacts/Relays for Remote Monitoring:

a. The control system shall provide ten (10) programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. Four (4) of these relays shall be preconfigured (and labeled accordingly) to indicate:

1) generator set operating at rated voltage and frequency
2) common warning

3) common shutdown
4) load shed command

b. A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

2.05 GENERATOR REMOTE MANUAL STOP STATION

A. Each generator set shall be furnished with a remote manual stop station of a type to prevent inadvertent or unintentional operation per NFPA 110 requirements.

B. Stop station pushbutton shall be red, non-illuminated, push-pull, mushroom-type, maintained-contact, 1 5/8" diameter, 30mm base, heavy-duty, oil-tight, water-tight unit) mounted within guarded enclosure to prevent inadvertent operation and labeled with engraved nameplate (white letters on red background) to read: "GENERATOR EMERGENCY STOP" (or similar with specific generator name where so identified on drawings).

C. Exact stop station type shall be coordinated with generator controls supplier to ensure a fully-functional system per NFPA 110 requirements.

2.06 GENERATOR MAIN LINE CIRCUIT BREAKER(S)

A. The generator set shall be provided with a mounted main line circuit breaker(s), sized as shown on plans. The circuit breaker(s) shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

B. The main line circuit breaker(s) shall be provided with auxiliary contacts to indicate trip/off alarm conditions to the generator set control system.

2.07 OUTDOOR WEATHER-PROTECTIVE ENCLOSURE

A. The generator set shall be provided with a weatherproof, sound-attenuated, outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (if applicable) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

B. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 76 dBA (including exhaust noise) at any location 7 meters from the generator set in a free field environment:

C. The enclosure shall include vertical air discharge hoods as required to redirect discharge air upwards and reduce noise accordingly.

D. The enclosure shall be insulated with non-hydroscopic materials.

E. The enclosure shall be rated for the wind and seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.

F. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
5. Salt Spray, per ASTM B117-90, 1000+ hours.
6. Humidity, per ASTM D2247-92, 1000+ hours.
7. Water Soak, per ASTM D2247-92, 1000+ hours.

G. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

H. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

I. A factory-mounted critical exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

J. The enclosure shall include the following maintenance provisions:

1. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
2. External radiator fill provision.

2.08 SEQUENCE OF OPERATION

A. The maximum elapsed time allowed from loss of normal power to restoration of power to emergency circuits from generator through transfer switch shall be 10 seconds.

B. Generator set shall start upon receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control.

1. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.

C. The generator set shall complete a time delay start period as programmed into the control.

D. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.
2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.
3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand or load govern state.

E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

G. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

PART 3 - EXECUTION

3.01 SUBMITTALS.

A. Within 10 days after award of contract, provide six sets of the following information for review:

1. Manufacturer’s product literature and performance data, sufficient to verify compliance to specification requirements.

2. Where generator is to be fed from a dedicated natural gas fuel service, a letter from the utility source acknowledging availability of the necessary gas service along with all associated requirements of the utility provider.
3. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
4. Manufacturer's certification of prototype testing.
5. Manufacturer's published warranty documents.
6. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
7. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
8. Generator sizing software report(s) showing compliance with all specification requirements and any additional motor starting requirements indicated in contract documents.
9. Time-current-curves demonstrating that the generator alternator relaying or breaker protective device(s) provide proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator.
10. Manufacturer's installation instructions.

3.02 FACTORY TESTING.

A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.03 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring, fuel lines, etc. between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Generator equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Contractor shall be responsible for coordinating (prior to providing submittal data) and providing complete engine fuel system, including gas service from the local gas utility company, all piping, pressure regulators, strainers, control valves, etc. as required for a fully-functional, code-compliant fuel system. Entire installation shall be provided in strict conformance with all recommendations and requirements of the generator manufacturer. All costs (including aid-to-construction costs from the local gas company where the generator is to be fed directly from a dedicated natural gas service) shall be included in bid cost. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.

E. Remote stop station type, labeling and location shall be submitted by contractor to engineer and local fire marshal for approval prior to rough-in. Location shall be outside the room housing the prime mover (where so installed within a room) or elsewhere on the premises where the prime mover is located outside the building. Contractor shall provide all interconnections from remote stop station to generator set as required by generator set supplier for a fully-functional system.

F. Equipment shall be initially started and operated by representatives of the manufacturer.

G. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.04 ON-SITE ACCEPTANCE TEST:

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include the following (performed in accordance with NFPA 110):

1. "Cold start" test.
2. Four (4) hour full load test. Provide resistive load banks and make temporary connections as required.
3. One step rated load pickup test.
4. Power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.05 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to not less than 5 persons. Training date shall be coordinated with the facility owner.

3.06 SERVICE AND SUPPORT

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be distributed and serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer of the generator set shall own, maintain and make available (to engineer, free of charge) generator set sizing software that calculates voltage dip, frequency dip, THDI and THDV of proposed generator/alternator set using the following inputs:

1. Summary of step loads including load type (across-the-line motor, VFD, Fire Pump, Fluorescent Lighting, UPS, etc.).
2. Generator Set Duty (Standby, Prime, Continuous).
3. Maximum Ambient Temperature.
4. Project site altitude.
5. Generator Fuel type.
6. Voltage/Phase/Frequency.

D. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.07 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 16231

SECTION 16268 - REDUCED VOLTAGE SOFT STARTERS, 600VAC

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. These specification requirements are for solid state reduced voltage motor controllers rated 600VAC and below, herein referred to as soft starters.

B. They are for use with AC motors to reduce the current in-rush as well as mechanical shocks that can result from starting or stopping a motor across the line.

1.02 QUALITY ASSURANCE

A. The electronic “soft starter” shall be listed by an independent testing laboratory in accordance with UL 508 - Industrial Control Equipment.

B. The soft start shall carry the CE mark for indication of compliance to low voltage and EMC directives in accordance with EN / IEC 60947-4-2.

C. The manufacturer shall be a certified ISO 9001 facility.

1.03 SUBMITTALS

A. Submittals shall be furnished in accordance with Specification Section 16050.

B. Provide the following for each Soft Start unit:

1. A job-specific, custom wiring diagram

    a. The wiring diagram shall clearly show all control components connected to the starter (whether the components are mounted internal or external to the soft start enclosure).
    b. All wires and terminal blocks shall be clearly labeled.
    c. Diagram shall be in accordance with NEMA/ICS standards.

2. Size, type and rating of all system components.
3. Enclosure frontal elevation and dimension drawings.
4. Internal component layout diagrams.
5. Available conduit entry and exit locations.
6. Manufacturer’s product data sheets for all components.

C. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated Soft Starter shall be provided.

1.04 WARRANTY

A. An eighteen-month warranty shall be provided on materials and workmanship from the

date of owner acceptance/substantial completion after completion of startup.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. The soft starter equipment shall be:

1. Square 'D' or Cutler Hammer.
2. Or pre-approved equal meeting the detailed requirements of this specification. Note that all “named” Manufacturers are obligated to meet the detailed requirements of this specification. Any proposed exceptions shall be clearly stated at bid time, citing the reason for noncompliance, and the cost for providing a conforming product. Failure to provide a detailed list of proposed exceptions may cause a bid to be deemed non-responsive. The Engineer will be the sole determiner of the acceptability of a proposed exception.

2.02 GENERAL DESCRIPTION

A. Refer to Specification Section 16443 (Motor Control Centers) or Specification Section 16480 (Manufactured Control Panels) as applicable for additional requirements (for enclosure, component types, etc.).

B. The soft starter shall be provided complete with a main circuit breaker disconnect means for Type 1 short circuit overcurrent protection as follows:

1. Short circuit withstand rating shall be equal to or greater than the AIC rating listed on the plans for the distribution equipment (motor control center, panelboard, switchboard, etc.) that feeds the soft starter.
2. Where the soft starter installed within a motor control center, refer to Motor Control Centers Specification Section 16443.
3. Sized by manufacturer per NEC requirements for corresponding motor load.

C. The motor shall be automatically protected from solid state component failure by the following means:

1. Isolation contactor that opens when the motor is stopped or when the controller detects a fault condition including a shorted SCR.

D. The soft starter shall utilize an SCR bridge consisting of at least two SCRs per phase to control the starting and stopping of industry standard motors.

1. SCR stacks shall be arranged horizontally for proper heat management.
2. Heat sinks sized for specified Starts Per Hour without requiring auxiliary cabinet cooling fans.

E. The soft start shall provide torque control for linear acceleration independent of motor load or application type without external feedback. The gating of the SCRs shall be controlled in such a manner to ensure stable and linear acceleration ramp.

F. The soft starter shall be controlled by a microprocessor that continuously monitors the current and controls the phasing of the SCRs. Analog control algorithms will not be allowed.

G. All soft starter power ratings shall utilize the same control board/module.

H. A shorting contactor shall be standard on soft starters in all enclosure configurations. Protective features and deceleration control options integral to the soft starter shall be available even when the shorting contactor is engaged.

2.03 MOTOR DATA

A. Each Soft Starter shall be sized to operate the AC motors defined to match load schedules and other specification documents as follows:

1. Motor Horsepower and voltage rating(s) – See electrical drawings and schedules.
2. Motor full load amperes, RPM and service factor ratings as stated within the individual motor specification documents.

B. The Soft Starter manufacturer shall be responsible for verifying each exact motor amperage, horsepower, voltage, RPM and service factor with motor equipment supplier prior to submitting shop drawings.

2.04 ENVIRONMENTAL RATINGS

A. The soft start shall be designed to operate in an ambient temperature 0°C to 40°C (14°F to 104°F). For ambient temperatures between 40°C and 60°C (104°F and 140°F), derate the current by 2% per °C above 40°C (104°F).

B. Storage temperature range shall be -25°C to 70°C (-13°F to 158°F).

C. Maximum relative humidity shall be 95%, non-condensing or dripping water, conforming to IEC 60947-4-2.

D. The soft starter shall be designed to operate in altitudes up to 1000m (3300 ft). For higher altitudes, derate by 2.2% for each additional 100 m (330 ft) with a maximum of 2000m (6600 ft).

2.05 ELECTRICAL RATINGS

A. The soft starter shall be capable of operation between + / - 10% of nominal voltage rating.

B. The soft start shall automatically adapt for operation at 50 or 60 Hz, with a frequency tolerance of +/- 5%. By configuration, it shall be capable of operation at a supply line frequency that can vary by +/- 20% during steady state operation.

C. The soft start unit amperage shall be the greater of the following:

1. 110% of the NEC amperage rating associated with the horsepower rating shown on the plans (for heavy duty Class 20 starting).
2. 100% of the unit amperage rating shown on the plans (for heavy duty Class 20 starting).

D. The soft start shall be capable of supplying 400% of rated full load current (of the soft starter) for 23 seconds at maximum ambient temperature. The soft starter shall also be capable of 10 evenly spaced starts per hour at 400% of full rated current (of the soft starter) for 12 seconds per start.

E. The soft start shall have a coordinated short circuit rating equal to or in excess of the minimum value listed on the piece of distribution equipment that feeds the soft start. This rating shall be listed on the nameplate. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings.

F. The SCRs shall have a minimum P.I.V. rating of 1800 Vac. Lower rated SCRs with MOV protection are not acceptable.

G. A seismic qualification label shall be provided for all wall and floor mount units to comply with the latest IBC and NFPA 5000 guidelines where installed in seismic zones C, D, E or F.

2.06 ADJUSTMENTS AND CONFIGURATIONS

A. All programming/configuration devices, display units, and field control wiring terminals shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.

B. Digital indication shall provide, as a minimum, the following conditions:

1. Soft starter status - ready, starting/stopping, run.
2. Motor status - current, torque, thermal state, power factor, operating time, power in kW.
3. Fault status - Motor thermal overload, soft starter thermal fault, loss of line or motor phase, line frequency fault, low line voltage fault, locked rotor fault, motor underload, maximum start time exceeded, external fault, serial communication fault, line phase reversal fault, motor overcurrent fault.

C. The soft starter shall be preset to the following for adjustment-free operation in most applications:

1. Linear (torque-controlled) acceleration ramp of 15 seconds.
2. Current limitation to 300% of the motor full load current rating.
3. Class 10 overload protection.
4. Motor current preset per NEC / NFPA 70 table 430.150 for standard hp motors.

D. The exact acceleration ramp time/type, current limitation, overload protection type and

motor current shall be set in the field by the startup technician prior to equipment startup as recommended/approved by the motor supplier.

E. A digital keypad shall be utilized to configure the following operating parameters as required:

1. Motor full load amps adjustable from 40 to 130% of the soft starter's rating.
2. Current limitation on starting adjustable from 150 to 700% of the motor current rating, not to exceed 500% of the soft starter rating.
3. Linear (torque-controlled) acceleration ramp adjustable from 1 to 60 seconds.
4. Initial torque adjustable from 10 to 100% of nominal motor torque.
5. Torque limit adjustable from 10 to 200% of nominal motor torque.
6. Maximum start time adjustable from 10 to 999 seconds.
7. Voltage boost adjustable from 50 to 100% of the nominal supply voltage.
8. Selection of freewheel, soft stop or braking.
9. Linear (torque-controlled) deceleration ramp time adjustable from 1 to 60 seconds.
10. Threshold to change to freewheel from a controlled deceleration ramp to freewheel stop: adjustable from 0 to 100% of the nominal motor torque.
11. Braking torque level adjustable from 0 to 100% effectiveness.
12. Selection of Class 2, 10, 10A, 15, 20, 25 or 30 motor thermal overload protection.

F. A digital keypad shall be utilized to configure the following controller parameters as required:

1. Selectable automatic reset operation.
2. Cancellation of the torque control loop for multi-motor installations.
3. Adjustment of the stator loss estimation for specialty motors.
4. Assignment of soft starter inputs and output control terminals.
5. Activation of line phase reversal protection.
6. Reset of motor thermal state.
7. Return to factory settings.
8. Activation of test mode for use with low power motors.
9. Indication of elapsed time in hours of starting, running and stopping.

G. Output relays shall provide the following status indications:

1. One Form A (N.O.) minimum for indication of fault.
2. One Form A (N.O.) for indication that acceleration ramp is complete and current is below 130% motor FLA (end of start).
3. One Form A (N.O.) assignable to one of the following functions: motor thermal alarm, motor current level alarm or motor underload alarm.

H. Additional inputs and outputs shall be available to provide the following status indications:

1. Two assignable control inputs for the following functions: force to freewheel stop, external fault input, disable serial link control, external motor overload reset or general fault reset.
2. Two assignable logic-level signal outputs for the following functions: motor thermal overload alarm, “motor powered” signal, motor overcurrent alarm, or motor underload alarm.
3. One analog output shall be available for 4 to 20 milliamp indication of motor current, motor torque, motor power, motor thermal state, or power factor.
4. Other inputs/outputs as shown on electrical drawings.

I. Relay and I/O functions listed above shall be isolated with respect to common.

2.07 PROTECTION

A. A microprocessor-based thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft starter and provides:

1. A motor overload pre-alarm that indicates by relay contact or logic output that the motor windings have exceeded 130% of its rated temperature rise. This function shall be for alarm only.
2. A motor overload fault shall stop the motor if the windings have exceeded 140% of temperature-rise.
3. An electronic circuit with a time-constant adjustable to the motor's thermal cooling time-constant ensuring the memorization of the thermal state even if power is removed from the soft starter.

B. The soft starter shall provide line and motor phase loss, phase reversal, underload, stall, and jam protection.

C. The integral protective features shall be active even when the shorting contactor is used to bypass the SCRs during steady state operation.

2.08 CONTROL OPTIONS

A. The soft starter control circuit shall be fed from the line supply and be completely independent of the power circuit and separate from the control logic.

B. The peripheral soft starter control circuitry shall be operated at 120 Vac 60 Hz from a control power transformer included within the enclosure.

C. Operator devices shall be door mounted, functions/types as shown on drawings.

D. All operator devices shall be remote-mounted using supplied 120 Vac control logic. Clearly labeled terminals shall be provided for field installation.

E. All wiring shall be clearly identified on each end to match the wiring diagram(s) provided with the soft starter.

F. Refer to Specification Section 16443 (Motor Control Centers) or Specification Section

16480 (Manufactured Control Panels) as applicable for all operator device and control component requirements (for pushbuttons, indicator lights, selector switches, relays, control wiring, etc).

2.09 COMMUNICATIONS

A. The RVSS shall be able to be connected to communication network type(s) as indicated on plans or required by the SCADA Integrator (exact network/protocol type(s) required shall be as directed by the facility SCADA Integrator). Where no specific network connections are specified on plans or required by the SCADA Integrator, the RVSS shall be provided with at least one of the following network communication options:

a. Modbus RTU serial
b. Ethernet TCP/IP
c. Ethernet IP

B. The communication shall be able to provide access to the control, to the adjustment and to the supervision of the soft starter.

C. No additional compensation will be granted to provide gateways, network components, etc. to properly communicate with the facility SCADA system. Equipment supplier is responsible for verifying all network connection requirements with the SCADA Integrator prior to bid.

2.10 INPUT SURGE PROTECTION

A. Each RVSS that does not have an upstream isolation contactor, and is not mounted within an MCC that has its own main bus surge protection shall be provided with a 3-phase, line-side surge protection device rated 80kA (per phase) or greater. The lead length between the surge protection device and the drive terminals shall be 12” or less. The surge protection device shall be designed / located / isolated such as to prevent / limit potential physical damage to other components within the enclosure if the surge protection device fails.

2.11 SHORTING CONTACTOR

A. A microprocessor shall control the operation of the shorting contactor via an output relay.

B. The shorting contactor shall close, shorting the SCRs after the acceleration ramp is compete and motor current is below 130% of motor FLA, and open on a stop command to allow a deceleration ramp.

C. Overload protection integral to the soft starter shall continue to protect the motor when shorting is engaged.

2.12 FULL VOLTAGE BYPASS STARTER

A. Where specifically shown on contract drawings, a full voltage NEMA-rated bypass starter with melting alloy overload protection shall be included to provide motor

operation in the case of soft starter failure. A “RVSS/BYPASS” selector switch shall be mounted on the enclosure door. The melting alloy protection shall provide overload protection if the “RVSS/BYPASS” selector switch is in the “BYPASS” position, and the RVSS shall provide overload, etc. protection if the “RVSS/BYPASS” selector switch is in the “RVSS” position.

B. Where a bypass is provided, the operator shall have full control of the bypass starter by operation of a RVSS/BYPASS selector switch mounted to the front of the starter door.

C. Where a bypass is provided, a NEMA-rated RVSS line isolation contactor shall be sequenced with the NEMA-rated bypass starter to provide isolation of each starter from the other.

2.13 ISOLATION CONTACTOR

A. An IEC or NEMA-rated isolation contactor shall be provided that opens when the motor is stopped or when the controller detects a fault condition including a shorted SCR.

B. The isolation contactor shall be located on the line side of the associated controller.

PART 3 - EXECUTION

3.01 TESTING

A. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications.

B. Power semiconductors shall be fully tested for proper electrical characteristics, including dv/dt and di/dt.

C. All subassemblies shall be inspected and/or tested for conformance to quality assurance specifications.

D. Each completed unit shall be functionally tested prior to shipment to assure conformance to the specifications.

3.02 DELIVERY, STORAGE AND HANDLING

A. Handling and shipment of the equipment shall be in such a manner to prevent internal component damage, breakage, and denting and scoring of the enclosure finish.

B. Equipment shall be stored indoors in a clean, dry environment as directed by the equipment supplier. Energize anti-condensation space heaters if so required.

1. Verify that the location is ready to receive work and the dimensions are as indicated.
2. Do not install Soft Starter equipment until the building environment can be maintained within the service conditions required by the manufacturer.

3.03 INSTALLATION

A. Installation shall comply with manufacturer's instructions, drawings and recommendations.

B. A job-specific, custom wiring diagram for each soft start unit shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring diagram shall clearly show all control components connected to the starter (whether the components are mounted internal or external to the soft start enclosure). All wires and terminal blocks shall be clearly labeled. A laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated unit.

C. Operations and Maintenance Manuals shall be provided to the owner for all Soft Starter components, control wiring, etc.

D. Operations and Maintenance Manuals shall include hardcopy printouts of all device settings and programming.

E. For safety, reliability, and continuity of warranty, any modifications, alterations, etc. required to conform to the requirements of this specification shall be performed by the Starter manufacturer only. Distributor modifications, third party packaging, etc. of a manufacturer’s standard product are specifically disallowed.

3.04 START UP AND TRAINING

A. The services of a qualified manufacturer's service representative shall be available to install, test, and start up all soft starts furnished under this specification. The schedule of the startup(s) shall be determined by the contractor.

B. Services shall include a minimum of eight (8) hours of field/classroom training for owner’s personnel on routine operation and maintenance of the specified units.

3.05 SPARE PARTS

A. The following spare parts shall be provided at no extra cost to the Owner:

1. One of each type and size of control fuse.
2. Three of each type and size of power fuse.

END OF SECTION 16268

SECTION 16289 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (<1000 V) power distribution and control equipment.

B. The specified unit(s) shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit(s) shall be connected in parallel with the facility's wiring system.

C. The unit(s) shall be designed and manufactured in North America by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacturer of such products for minimum of ten (10) years.

D. All products that are submitted according to these specification will be required to meet this specification in it's entirety for both service and distribution TVSS systems. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

1.03 DEFINITIONS

A. VPR: Voltage Protection Rating.

B. SPD: Surge Protective Device(s)

C. $I_{(n)}$: Nominal Discharge Current

1.04 SUBMITTALS

A. See specification section 16050.

B. Product Data: For each type of product indicated. Include:

1. Maximum Single Impulse Surge Current Rating.
2. Surge Life (Repetitive Surge) Rating.
3. UL1449 (Latest Edition) Voltage Protection Ratings (VPR).
4. UL1449 (Latest Edition) Nominal Discharge Current (In).
5. Product dimensions and weights.

6. Furnished specialties and accessories.

C. Qualification Data:

D. Safety Agency File Number.

E. ISO 9001-2008 Certification.

F. ISO 1401-2001 Certification.

G. Operation and Maintenance Data: For SPDs to include all submittal data and any applicable operation and maintenance manuals.

H. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference Filter

C. Provide 2nd party certified data demonstrating SPD response to ANSI/IEEE C62.41.2-2002 standard waveforms when tested according to IEEE C62.45.

D. Comply with NFPA 70.

E. All SPDs provided within this project at the service entrance, distribution panels, and sub-panels shall be from the same manufacturer.

1.06 PROJECT CONDITIONS

A. Service Conditions: Rate SPDs for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 150 deg F.
3. Humidity: 0 to 95 percent, non-condensing.
4. Altitude: Less than 13,000 feet above sea level.

1.07 COORDINATION

A. Where field-mounted SPD’s are specifically shown on plans, coordinate locations of field-mounted SPDs to allow adequate clearances for maintenance.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: 1 of each size and type installed, where field-replaceable modular SPDs are provided.
2. Fuses: 1 of each size and type installed, where field-replaceable fuses are provided.

PART 2 - PRODUCTS

2.01 SURGE PROTECTIVE DEVICES

A. Manufacturer:

1. Integral Devices: Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.), or by Surge Suppression Inc. if all of the performance of this specification are met and all UL listing of the equipment manufacturer are met.
2. External Devices (where specifically specified on plans): Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.) or Surge Suppression Inc.

B. Each Surge Protective Device shall:

1. Be internal to the associated distribution equipment (without violating any applicable UL listings) unless specifically shown otherwise on plans.
2. Be UL 1449 (Latest Edition) listed.
3. Have short-circuit current rating complying with UL 1449 (Latest Edition), that matches or exceeds the short-circuit rating of the associated distribution equipment.
4. Be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
5. Have fuses, rated at 200-kA interrupting capacity.
6. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
7. Be fabricated using bolted compression lugs.
8. Provide suppression for all ten (10) modes of protection.
9. Have LED indicator lights for power and protection status of each phase.
10. Have audible alarm, with silencing switch, to indicate when protection has failed.
11. Have form-C contacts rated at 2 A and 24-V ac minimum, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any

current-limiting device. Coordinate with facility monitoring and control system if monitoring by that system is required by plans or other specifications.

12. Have six-digit transient-event counter, mounted to front of equipment door, set to totalize transient surges (externally mounted SPD's may have the transient – event counter monted on the visible face of the SPD).
13. Meet all UL 96A requirements (for Lightning Protection Systems) where the device is installed at a service entrance of the facility. At a minimum, these devices shall:

    a. Be marked as Type 1 or Type 2 SPDs with product Identity consisting of "Surge Protective Device" or "SPD", and identifying all ratings so required by UL96A and the 4 digit alpha numeric Control Number.
    b. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
    c. Be UL listed and labeled with holographic label.

C. Peak Single-Impulse Surge Current Rating shall be meet the following minimums unless specifically shown otherwise on plans:

Application	**Per Phase**	**Per Mode**
Service Entrance Devices	240 kA	120 kA
Downstream Devices	160 kA	80 kA

D. The ANSI/UL 1449 voltage protection rating (VPR) in grounded wye circuits, the SPDs shall not exceed the following:

Modes	**208Y/120V**	**480Y/277V**	**600Y/347V**
L-N,L-G, N-G	800	1200	1500
L-L	1200	2000	2500

E. The ANSI /UL 1449 VPR for 240/120 V, 3-wire or 4-wire circuits with high leg shall not exceed the following:

Modes	**240/120V**
L-N,L-G, N-G	1200/800

2.02 ENCLOSURES

A. Where external units are specifically specified on plans, units not mounted within electrical distribution equipment (such as switchboards, MCC's, etc.) shall be provided in enclosures with NEMA enclosure ratings that match or exceed the NEMA enclosure ratings of the equipment from which the units are fed. For example, a unit fed from a

NEMA 4X stainless steel panelboard shall also be mounted within a NEMA 4X stainless steel enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All SPD's shall be integrally-mounted within the associated distribution equipment unless specifically shown otherwise on plans.

B. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.

C. Install SPDs downstream of the service entrance with conductors or buses between suppressor and points of attachment as short and straight as possible. The lead lengths between the TVSS unit and the equipment being protected shall not exceed fourteen (14) inches without approval from the engineer. Do not bond neutral and ground. Leads shall be as straight as possible with no sharp bends.

D. Where externally-mounted SPD's are specifically shown on plans, provide circuit breaker as directed by the SPD supplier as a dedicated disconnecting means for SPD unless otherwise indicated.

3.02 FIELD QUALITY CONTROL

A. Ensure that interiors are free of foreign materials and dirt.

B. Check and test switches, pushbuttons, meters for proper operation.

C. Check and test indicating lights for proper operation and color.

D. Perform manufacturer's on site field test procedures.

3.03 STARTUP SERVICE

A. Do not perform insulation resistance (MEGGER) tests of the distribution wiring equipment with the SPDs installed. Disconnect all wires, including neutral, before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.04 SYSTEM WARRANTY

A. The SPD system manufacturer shall warranty the entire SPD system against defective materials and workmanship for a period of ten (10) years from the date of substantial completion. This warranty is in effect as long as the unit is installed in compliance with the manufacturer's installation, operation, and maintenance manual, UL Listing requirements, and any applicable national or local electrical codes.

B. Any SPD device which shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced by

the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period which starts at the date of substantial completion of the system to which the surge suppressor is installed.

C. The manufacturer is required to have a nationwide network of factory-authorized local service representatives for repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number shall be manned by a knowledgeable factory employee to ensure prompt response to any emergency situation that may arise.

END OF SECTION 16289

SECTION 16410 - SAFETY SWITCHES AND FUSES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Safety Switches

B. Fuses

C. Branch Feeders

D. Feeders

PART 2 - PRODUCTS

2.01 SAFETY SWITCHES

A. Safety switches shall be quick-make, quick-break, NEMA heavy duty type HD, fused or nonfused as shown. Switch blades shall be fully visible in the off position.

B. Safety switches shall be furnished with transparent internal barrier kits to prevent accidental contact with live parts. Barriers shall provide finger-safe protection when the switch door is open and shall allow use of test probes and removal of fuses without removing barrier.

C. Fused switches shall have provisions for class R, rejection type fuses.

2.02 FUSES (600V)

A. Fuses for all branch switches shall be Bussman Mfg. Co., Dual Element, Class “R” Fusetron.

B. Fuses for main switch/switches shall be Bussman Mfg. Co. Hi-Cap.

2.03 MANUFACTURER

A. Safety switches shall be as manufactured by Square 'D' or Cutler Hammer.

B. Fuses shall be as manufactured by Bussman Mfg. Co. or equal.

PART 3 - EXECUTION

3.01 SAFETY SWITCHES

A. Safety switches shall be installed as shown on the plans and in accordance with N.E.C.

B. Locations shown for safety switches on plans are diagrammatical only. Exact locations shall be field coordinated by contractor as required to provide code-required clearances.

C. Switch enclosures shall be rated NEMA I indoors in dry locations and NEMA 4X stainless steel outdoors and in wet or process areas.

D. Adequate support shall be provided for mounting safety switches. Safety switches shall not be mounted to the associated equipment (unless the safety switch is furnished with the equipment).

3.02 FUSES

A. Fuses shall be sized as shown on drawings, unless a smaller size is required by the associated equipment supplier, in which case the contractor shall provide fuses sized as directed by the associated equipment supplier at no additional cost.

B. Provide not less than one spare set of fuses for each size used. Provide an additional spare set for each five sets of same size fuses used.

END OF SECTION 16410

SECTION 16415 - AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: voltage sensors on all phases of both sources, power switch mechanism, permanently attached manual operation provisions, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product shall service the transfer switches.

1.02 CODES AND STANDARDS

A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. CSA 282, Emergency Electrical Power Supply for Buildings
2. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
3. NFPA99 – Essential Electrical Systems for Health Care Facilities
4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
6. NEMA ICS10-1993 – AC Automatic Transfer Switches.

B. The transfer switch assembly shall comply with the following standards:

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN55011, Class B Radiated Emissions
3. EN55011, Class B Conducted Emissions
4. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
5. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
6. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
7. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
8. IEC 1000-4-6 Conducted Field Immunity
9. IEC 1000-4-11 Voltage Dip Immunity.
10. IEEE 62.41, AC Voltage Surge Immunity.
11. IEEE 62.45, AC Voltage Surge.
12. UL1008 – Transfer Switches. Transfer switches shall be UL1008 (latest edition) listed. UL1008 transfer switches may be supplied in UL891 enclosures if necessary to meet the physical requirements of the project.

C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality

Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 ACCEPTABLE MANUFACTURERS

A. Cummins/Onan

B. Caterpillar

C. Generac

D. Kohler

E. Zenith

F. Russelectric

G. ASCO

H. Eaton

PART 2 - PRODUCTS

2.01 POWER TRANSFER SWITCH

A. Ratings

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes equal to or greater than the required ratings shown on the drawings (at the specified voltage). The transfer switch shall be third party listed and labeled for use with the specific protective device(s) (both normal and emergency) installed in the application. All rating information including associated overcurrent devices shall be submitted with shop drawings. Where WCR is dependent on setting of upstream overcurrent device, transfer switch shall be field marked with the required settings of the associated device. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. The transfer switch and its upstream protection shall be coordinated.

B. Construction

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches shall be of the Programmed (Delayed) Transition type. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.
3. The switch shall completely disconnect the load from both sources for an adjustable period of time to allow regenerative voltage to decay to a safe level prior to connecting to the new source.
4. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
5. All wiring shall be UL listed 105 degree C, 600 volt rated, and sized as required. Each wire, device or function shall be identified with a source and destination by silk-screen or similar permanent identification. Circuit boards shall be connected wiring harnesses by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
6. Bus structures shall be constructed from silver plated copper or tin plated aluminum with bolted joints for all three phases, with a full neutral, and a 1/4 x 2 inch ground bus extending through all sections.
7. The framework and all other sheet metal components of the system shall be primed with a rust-inhibiting primer, and finished with two coats of satin finish ANSI 61 gray enamel, or manufacturer's standard color.
8. All door mounted control components shall be industrial type oil-tight devices with contact ratings a minimum of twice the maximum circuit ampacity they are controlling. Toggle switches and other light duty and durability control devices are not acceptable. Indicator lamps shall be high intensity LED type devices. Indicator lamp condition (on or off) shall be easily visible in bright room lighting conditions.
9. Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation or shall be indicated by mechanical flags. Barriers shall be provided to prevent inadvertent contact with any voltage of greater than 50VDC.
10. Transfer switches shall be 3-pole with a solid neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

C. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU compression lugs suitable for the quantities and sizes of power conductors required.

2.02 TRANSFER SWITCH CONTROL

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
2. High intensity LED lamps to indicate that the transfer switch is "not in auto" (due to control being disabled or due to bypass switch (when used) enabled or in operation) and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.
3. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
4. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
5. "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via an operator display panel.
7. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:

    a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
    b. Display source status, to indicate source is connected or not connected.
    c. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

        1) Set nominal voltage and frequency for the transfer switch.
        2) Adjust voltage and frequency sensor operation set points.
        3) Set up time clock functions.
        4) Set up load sequence functions.
        5) Enable or disable control functions in the transfer switch, including program transition.

6) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

d. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall be incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
e. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
f. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
c. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.
d. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
e. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.
f. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

3. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature. The program/delayed transition time setting (time in which load is not connected to either source during transfer) shall be initially set at 10 seconds to allow motors to properly decay per MG-1 standard
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).
6. The transfer switch shall be configurable to accept a relay contact signal from an external device to prevent transfer to the generator service.
7. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage surge and RFI/EMI standards.
8. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

C. Control Interface

1. The transfer switch shall provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
2. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
3. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
4. The transfer switch shall provide additional relay contacts to indicate the following conditions: Utility Source Available, Load Connected to Utility, Generator Source Available, Load Connected to Generator, Pre-Transfer Warning (adjustable 0-59 second time delay).

2.03 ENCLOSURE

A. Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.

B. If not specifically indicated otherwise on plans, transfer switch equipment enclosures shall meet the following minimum requirements:

1. For dry interior locations: NEMA 1 or better (unless shown otherwise on plans).

2. For wet interior (pump stations, etc.) or exterior locations: NEMA 3R or better (unless shown otherwise on plans).

C. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

D. Note size and access requirements for the transfer switch (and associated equipment) and provide equipment that will fit into the space allowed and comply with code-specified access requirements.

2.04 BATTERY CHARGING

A. The transfer switch/generator set combination shall be provided with a battery charger for the generator set starting batteries. Refer to Generator Sets Specification Section 16231 for specific requirements. Supply power failed indication shall be displayed on the ATS control panel.

2.05 SEQUENCE OF OPERATION

A. Programmed (Delayed) Transition Sequence of Operation

1. Normal State:

a. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is connected to source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Normal Power Failure and Restoration:

a. When the transfer switch senses a power failure on source 1, it shall complete a pre-programmed time delay start sequence, and then send a start signal to the generator set.
b. The generator set shall immediately start and accelerate to rated voltage and frequency.
c. The transfer system shall complete a programmable time delay sequence, and then transfer to source 2 by delayed (programmed) transition. The transfer switch shall accomplish this by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard).
d. On return of source 1 to acceptable voltage and frequency levels, the control system shall initiate a time delay retransfer sequence. On completion of the time delay sequence, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source

contacts, and closing the normal source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller. The control system shall transfer loads back to source 1 in the reverse sequence to that which was used to connect loads to source 2.

e. If the generator set fails during this period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.
f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.

3. Generator Set Exercise (Test) With Load Mode (Delayed (programmed)Transition). The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set as follows:

1) On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
2) On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.

c. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller.
d. The generator set shall operate connected to the load for the duration of the exercise period.
e. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller.
f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.

g. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.
h. If the generator set fails during the exercise period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.

4. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set as follows:

1) On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
2) On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.

c. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
d. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 3 - EXECUTION

3.01 POWER COMPANY APPROVAL

A. The transfer switch shall be designed to meet all applicable power company requirements for connection to the power company's system, and if applicable, shall be on the power company's approved list of automatic transfer switches. Contractor shall ensure that transfer switch is specifically approved by power company for connection to their system prior to purchasing the transfer switch.

3.02 FACTORY TESTING

A. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be submitted. Test process shall include calibration of voltage sensors.

3.03 SERVICE AND SUPPORT

A. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

D. After generator set installation, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 5 persons employed by the facility owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be at least 4 hours in length, and include practical operation with the installed equipment.

3.04 WARRANTY

A. The automatic transfer equipment shall be warranted (by the generator supplier when a generator is supplied within the project) for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 16415

SECTION 16442 - LIGHTING PANELBOARDS

PART 1 - GENERAL

1.01 GENERAL

A. The work under this section includes but is not limited to the following:

1. Lighting Panelboards
2. Circuit Breakers

PART 2 - PRODUCT

2.01 PANELBOARDS

A. Enclosure:

1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in corrosive, exterior or wet locations shall have NEMA 4 stainless steel enclosures.
3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
8. Each section of multi-section panelboards shall be of matching heights and depths.

B. Bussing/Lugs:

1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
2. All bussing and associated connectors shall be tin-plated copper.
3. All panelboards shall contain ground buss.
4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings

shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

5. Buss connectors shall be for distributed phase arrangement.
6. Main and sub-feed lugs shall be provided with AL/CU compression lugs suitable for the quantities and sizes of conductors required.
7. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
8. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
9. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations

C. Breaker arrangement and numbering:

1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
3. Breaker numbers shall be permanently attached to trim.
4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

2.02 CIRCUIT BREAKERS

A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.

B. Circuit breakers shall be of the bolt-on type.

C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).

D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings

shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.03 SPECIAL REQUIREMENTS

A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

B. Lighting panels larger than 400A shall conform to the requirements for power panels.

2.04 MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D' or Cutler Hammer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6’-7” A.F.F..

B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

3.02 PANEL IDENTIFICATION

A. Refer to Specification Section 16075.

END OF SECTION 16442

SECTION 16443 - MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes requirements for motor control centers (MCC's) and all required control devices as shown on the drawing and specified to be part of the MCC equipment. The MCC shall be 277/480 V, 3-Phase, 4-Wire, 60 Hz unless otherwise indicated.

1.02 SUBMITTALS

A. Submittals shall be furnished in accordance with Specification Section 16050.

B. Submittals shall show separate views of the elevation, profile and conduit openings. The elevation shall show the section identification and the unit identification. The drawings shall give dimensions of size and location of the following:

1. Vertical section height, width and depth
2. Mounting channels
3. Conduit openings top and bottom
4. Wireway openings in sides
5. Horizontal buss
6. Ground buss

C. The submittals shall contain a summary of the design specification containing but not limited to the following:

1. NEMA type enclosure and class of wiring
2. Rated buss voltage
3. Current ratings for horizontal buss, vertical busses and ground buss
4. Buss material and plating

D. Buss bracing and sheet circuit rating

E. The submittals shall contain a listing of all modifications, options and special equipment.

F. The submittals shall contain a listing of each unit containing but not limited to the following:

1. Unit Location
2. Nameplate
3. Major contents of unit (fuse starter, CB switch, M.C.P., etc.) complete with NEMA size and heater rating or current rating.
4. Size of load served (H.P. KVA, KW, etc.).

G. Provide the following for each starter/controls unit:

1. A job-specific, custom wiring diagram

a. The wiring diagram shall clearly show all control components (whether the components are mounted internal or external to the MCC enclosure).
b. All wires and terminal blocks shall be clearly labeled.
c. Diagram shall be in accordance with NEMA/ICS standards.

2. Size, type and rating of all system components.
3. Unit frontal elevation and dimension drawings.
4. Internal component layout diagrams.
5. Manufacturer's product data sheets for all components.

H. Submittals shall be complete and electrical contractor shall review and approve all accessories required for control wiring prior to submittal

1.03 REGULATORY REQUIREMENTS

A. The MCC shall conform to Underwriters Laboratory (UL) 845, current revision, CSA, EEMAC, NEMA ICS-2, the latest version of the National Electrical Code, and the Canadian Electrical Code. The MCC shall be manufactured in an ISO 9001 certified facility.

1.04 WARRANTY

A. An eighteen-month warranty shall be provided on materials and workmanship from date of owner acceptance/substantial completion after completion of startup.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. Square 'D' or Cutler Hammer.

B. Additions to existing MCCs shall be the same as the original manufacturer.

2.02 MATERIALS

A. Steel material shall comply with UL 845 and CSA requirements.

B. Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly. A removable 7 gauge structural steel lifting angle shall be mounted full width of the MCC shipping block at the top. 10 gauge bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the shipping block. Vertical sections made of welded side-frame assembly formed from a minimum of 12 gauge steel. Internal reinforcement structural parts shall be of 12 and 14 gauge steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand normal stresses included in transit and during installation.

C. Each entire MCC assembly (including all sub-components) shall be rated to withstand (and provide proper breaker functionality within) the fault current ratings listed on the

plans. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. The fault current ratings listed shall be assumed to be at the input terminals of the associated MCC.

2.03 MCC FINISH

A. All steel parts shall be provided with UL and CSA listed acrylic/alkyd baked enamel paint finish, except plated parts used for ground connections. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.

B. Pre-treatment shall include:

1. Hot alkaline cleaner to remove grease and oil.
2. Iron phosphate treatment to improve adhesion and corrosion resistance.

C. The paint shall be applied using an electro-deposition process to ensure a uniform paint coat with high adhesion.

D. The standard paint finish shall be tested to UL 50 per ASTM B117 (5% ASTM Salt Spray) with no greater than 0.125 in (3 mm) loss of paint from a scribed line.

E. Paint color shall be #49 medium light gray per ANSI standard Z55.1-967 (60-70 gloss) on all surfaces unless specified otherwise. Paint color of additions to existing MCCs shall match that of the existing MCC. Control station plates and escutcheon plates shall be a contrasting gray.

2.04 STRUCTURES

A. Structures shall be totally enclosed, dead-front, free-standing assemblies. Structures shall be capable of being bolted together to form a single assembly.

B. The overall height of the MCC shall not exceed 90 in (2286 mm) (not including base channel or lifting angle). Lifting angles, of 3 in (76 mm) in height, shall be removable. The total width of one section shall be 20 in (508 mm); (widths of 25 in (630 mm), 30 in (760 mm), and 35 in (890 mm) can be used for larger devices). The total depth of each section shall be 20 in (508 mm) unless shown otherwise.

C. Structures shall be NEMA/EEMAC type 1 unless shown/specified otherwise.

D. Each 20 in wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.

E. Each section shall include a top plate (single piece or two-piece). NEMA/EEMAC type 12 shall also include a bottom plate. Top and bottom plates shall be removable for ease in cutting conduit entry openings.

F. All MCC components, terminations, wiring, etc. shall be fully accessible from the front of the MCC unless noted otherwise.

2.05 WIREWAYS

A. Structures shall contain a minimum 12 in (305 mm) high horizontal wireway at the top of each section and a minimum 6 in (152 mm) high horizontal wireway at the bottom of each section. These wireways shall run the full length of MCC to allow room for power and control cable to connect between units in different sections.

B. A full-depth vertical wireway shall be provided in each MCC section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway. The vertical wireway shall be 4 in (102 mm) wide minimum with a separate hinged door. There should be a minimum of 80 in^2 (516 cm^2) of cabling space available for 20-inch-deep sections. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units shall open directly into the MCC horizontal wireways.

C. All wireway doors shall be hinged and shall be held shut by captive hardware.

2.06 BARRIERS

A. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a two-piece rigid non-conductive barrier. The barrier design shall allow qualified personnel to slide the barriers both left and right, to allow access to the bus and connections for maintenance without having to remove the barrier. Barrier sliding shall occur via an upper and lower track system.

B. The vertical bus shall be housed in a molded glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3 in (75 mm) for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-in unit be removed from the MCC.

C. Barriers shall be provided in the vertical structure and unit designs to prevent the contact of any energized bus or terminal by a fishtape inserted through the conduit or wireway areas.

2.07 BUSSING

A. All bussing and connectors shall be tin-plated copper.

B. The main horizontal bus shall be rated as indicated on plans and shall extend the full

length of the MCC. Bus ratings shall be based on 65° C maximum temperature rise in a 40° C ambient. Provisions shall be provided for splicing additional sections onto either end of the MCC.

C. The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack is installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts shall not be required when splicing higher amperage bus. The splice bolts shall secure to self clenching nuts installed in the bus assembly. It shall be possible to maintain any bus connection with a single tool.

D. A neutral bus and/or neutral lugs (with amperage rating equal to that of the main horizontal bus) shall be provided for all 4-wire motor control centers.

E. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of copper and plating as the main bus, and shall be rated 300 A or 600 A continuous based on UL standards (and the associated loads connected to the bus). The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. It shall be possible to maintain the vertical to horizontal bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.

F. A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The ground bus shall be rated for 25% (minimum) of the main horizontal bus amperage. Compression lugs shall be provided in the MCC for a ground cable, sized to accommodate the grounding connections shown on plans. The ground bus shall be provided with six (6) holes for each vertical section to accept customer-supplied ground lugs for any loads requiring a ground conductor.

G. Each vertical section shall have a tin-plated copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

H. The system shall be rated for an available short circuit capacity as indicated on plans. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless specifically shown otherwise on drawings.

2.08 TYPICAL UNIT CONSTRUCTION

A. Units with circuit breaker disconnects through 400 A frame, and fusible switch disconnects through 400 A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.

B. All circuit breakers rated (or able to be adjusted to) 1200A or higher shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.

C. All circuit breakers shall have adjustable magnetic trip settings. Provide a field adjustable breaker to allow for one breaker for each NEMA size starter. The adjustment range shall include current range to encompass the entire range of each size starter. There shall also be adjustments to select either standard or high inrush magnetic settings, from 6 times to 13 times motor full load current. If a standard, non adjustable, magnetic only trip breaker is furnished for a combination starter unit, the manufacturer shall include in the bid cost to furnish and install replacement breakers at jobsite if equipment changes dictate.

D. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

E. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.

F. A lever handle operator shall be provided on each disconnect. With the unit stabs engaged onto the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door. Clear indication of disconnect status shall be provided, by adhering to the following operator handle positions:

1. Handle "On" position shall be up or to the left and within 45 degrees of being parallel to the face of the equipment.
2. Handle "Off" position shall be down or to the right and within 45 degrees of being parallel to the face of the equipment.
3. The minimum separation between the "On" and "Off" positions shall be 90 degrees.
4. On Circuit Breaker disconnects, the handle "Tripped" position shall be perpendicular to the face of the equipment +/- 30 degrees. Minimum separation between "On" and "Tripped" shall be 30 degrees. Minimum separation between "Tripped" and "Off" shall be 45 degrees.

G. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

H. A non-defeatable interlock shall be provided to prevent installing or removing a plug-in unit unless the disconnect is in the OFF position.

I. The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

J. Provisions shall be provided for locking all disconnects in the OFF position with up to three padlocks.

K. Handle mechanisms shall be located on the left side to encourage operators to stand to the left of the unit being switched.

L. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.

M. All unit doors shall be hinged and shall be held shut by captive hardware.

N. Interiors of all units shall be painted white.

2.09 COMPONENTS FOR TYPICAL UNITS

A. Main Lugs

1. Main and sub-feed lugs shall be provided with AL/CU compression lugs suitable for the quantities and sizes of conductors required.

B. Circuit Breakers

1. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.
2. Circuit breakers shall be quick-make and quick-break, whether actuated automatically or manually. Circuit breakers shall have inverse time tripping characteristics with automatic release which shall trip free of the handle. Circuit breaker handles shall be three distinct positions—“OFF”, “ON”, and “TRIPPED”. When a circuit breaker opens on overload or short circuit, the operating handle shall automatically assume the “TRIPPED” position.

C. Combination Starters

1. All combination starters shall utilize a unit. Magnetic starters shall be furnished in all combination starter units unless specifically shown otherwise. All starters shall utilize full NEMA/EEMAC rated contactors (size 1 minimum).
2. Starters shall be provided with a three-pole, external (door mounted) manual reset, solid state overload relay . Solid state overload relay shall have switch-selectable trip class and shall provide protection from:

    a. Overload.
    b. Phase Unbalance.
    c. Phase Loss.
    d. Ground Fault (Class II detection).

3. Unless specifically shown otherwise, each combination starter shall be furnished with a control circuit transformer including two primary protection fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads (including motor space heaters and other similar loads where specified). The transformer rating shall be fully visible from the front when the unit door is opened. Unless otherwise indicated, control voltage shall be 120V AC. Control power shall be provided by individual unit control power transformers.
4. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
5. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.
6. NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.
7. Each starter shall be equipped with a minimum of the following control devices:

    a. Door-mounted reset button.
    b. Two (2) field-reversible (N.O./N.C.) auxiliary contacts
    c. For reversing and two-speed starters: Four (4) field-reversible (N.O./N.C.) auxiliary contacts
    d. Additional control devices as indicated on plans.

D. Terminal Blocks

1. Wiring within all units shall be type B, with unit-mounted control terminal blocks for each field wire.
2. Terminal blocks shall be the pull-apart type 600 volt and rated at 25 amps. All current carrying parts shall be tin plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be DIN rail mounted with the stationary portion of the block secured to the unit bottom plate. The stationary portion shall be used for factory connections, and shall remain attached to the unit when removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components.

E. Nameplates

1. Each unit shall be properly labeled with an engraved phenolic nameplate with a white background and black letters.
2. Each pilot device shall be properly labeled with a legend plate or an engraved phenolic nameplate.

F. Wiring

1. All wiring shall be identified on each end with hot stamped or shrink tube type permanent wire markers to correspond with numbering shown on wiring diagrams.

G. Wiring Diagram

1. A job-specific, custom wiring diagram for each unit shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring diagram shall clearly show all control components connected to each unit (whether the components are mounted internal or external to the soft start enclosure). All wires and terminal blocks shall be clearly labeled. A laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated unit.

H. Control Components:

1. All pushbuttons, pilot lights, selector switches and other control devices shall be separate, standard size (full 30mm) and shape, heavy duty oil-tight units.
2. All pilot lights to be cluster LED type & push to test.
3. Relays:

a. Control relays shall have the following characteristics, unless noted otherwise:

1) General purpose, plug-in type.
2) Minimum mechanical life of 10 million operations.
3) Coil voltage as indicated or required by application.
4) Single-break contacts rated 12 amperes, resistive at 240 volts.
5) Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each individual relay shall have 3PDT contacts. Where required, multiple control relays shall be provided (to provide the required quantities of contacts) for each “relay” function shown on plans/diagrams.
6) Furnished with RC transient suppressor to suppress coil-generated transients to 200% of peak voltage.
7) LED on/off indicator light and manual operator.
8) Industry standard wiring and pin terminal arrangements.
9) Equal to Square D 8501KP series with matching plug-in socket.

b. Interposing/isolation relays used to isolate input/output field wiring from PLC inputs/outputs shall be terminal-block style. Terminal-block style relays shall have the following characteristics, unless noted otherwise:

1) Minimum mechanical life of 10 million operations.
2) Single-break contacts rated 6 amperes, resistive at 120 volts.
3) One (1) N.O. contact per relay.
4) Furnished with integral transient protection.
5) LED on/off indicator light.

6) DIN-rail mounted.
7) Equal to Square D type Zelio RSL.

c. Timer relays shall be electronic, adjustable plug-in devices meeting the following characteristics, unless noted otherwise:

1) General purpose, plug-in type.
2) Minimum mechanical life of 10 million operations.
3) Single-break contacts rated 10 amperes, resistive at 240 volts.
4) Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each relay shall have DPDT contacts (2 N.O. & 2N.C.). Where required, multiple timer or control relays shall be provided (to provide the required quantities of contacts) for each "relay" function shown on plans/diagrams.
5) Rotary-thumbwheel adjustments for time value, timing range and function.
6) Time value adjustments from .05 seconds to 999 hours
7) Selectable Timing Functions, including the following:

(a) On Delay
(b) Interval
(c) Off Delay
(d) One Shot
(e) Repeat Cycle-Off
(f) Repeat Cycle-On
(g) On/Off Delay
(h) One Shot Falling Edge
(i) Watchdog
(j) Trigger On Delay

8) Accuracy shall be $\pm$ 2% and repeatability shall be $\pm$ 0.1%.
9) Furnished with integral transient protection.
10) LED indicator light(s) for "timing" and "on/off status"
11) Held in place with hold-down spring
12) Equal to Square D type JCK with matching plug-in socket.

2.10 SOFT START CONTROLLERS

A. Refer to Section 16268.

2.11 QUALITY CONTROL

A. The entire MCC shall go through a quality inspection before shipment. This inspection shall include:

1. Physical Inspection of:

a. Structure.

b. Electrical conductors, including:

1) bussing.
2) general wiring.
3) units.

2. Electrical Tests

a. General electrical tests include:

1) power circuit phasing.
2) control circuit wiring.
3) instrument transformers.
4) meters.
5) ground fault system.
6) device electrical operation.

b. AC dielectric tests shall be performed on the power circuit.

3. Markings/Labels, include:

a. instructional type.
b. Underwriters Laboratory (UL)/Canadian Standards Association (CSA).
c. inspector's stamps.

4. The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.

B. The motor control center design shall be in accordance with the latest applicable standards of NEMA and Underwriters Laboratories.

2.12 SPECIAL REQUIREMENTS

A. Where the schedules and diagrams show deviations from these Specifications, the schedules and diagrams shall take precedence, but only for the particular feature.

PART 3 - EXECUTION

3.01 PACKING/SHIPPING

A. The MCC shall be separated into shipping blocks no more than three vertical sections each. Shipping blocks shall be shipped on their sides to permit easier handling at the jobsite. Each shipping block shall include a removable lifting angle, which shall allow an easy means of attaching an overhead crane or other suitable lifting equipment.

3.02 STORAGE

A. If the MCC cannot be placed into service reasonably soon after its receipt, store it in a clean, dry and ventilated building free from temperature extremes. Acceptable storage

temperatures shall be determined by the manufacturer. Anti-condensation space heaters shall be provided during equipment storage as directed by the manufacturer.

3.03 LOCATION

A. Motor control centers shall not be placed in hazardous locations. The area chosen shall be well ventilated and totally free from humidity, dust and dirt. Where the minimum temperature of the area is less than 0° C (32° F), space heaters shall be provided within the motor control center. Where the minimum temperature of the area is greater than 40° C (104° F) ventilation fans and/or air conditioning units shall be provided within the motor control center as required to provide adequate cooling for each unit. For indoor locations, protection shall be provided to prevent moisture entering the enclosure .

B. Motor control centers shall be located in an area with a minimum of 4 ft (1219 mm) of free space in front of front-of-board construction. This free space shall give adequate room to remove and install units. A minimum of 0.5 in (13 mm) space should be provided between the back of front-of-board MCCs and a wall, 6 in (152 mm) required for damp locations.

C. The MCCs shall be assembled in the factory on a smooth level surface so that all sections are properly aligned. A similar smooth and level surface shall be provided for installation. An uneven foundation will cause misalignment of shipping blocks, units, and doors. The surface under a MCC shall be of a non-combustible material unless bottom plates are installed in each vertical section.

3.04 INSTALLATION

A. Motor control centers shall be installed on six inch thick concrete pads unless specifically shown otherwise. Pad shall extend a minimum of four inches to all sides and shall have beveled edges.

B. Orientation of motor control centers shall be as shown on the Engineer’s drawings. Space requirements are critical on this project and therefore special care shall be taken to insure that equipment will fit in the designated space. To insure proper coordination, the MCC manufacturer shall submit with shop drawings a 1/2”=1’-0” scale floor plan of each electrical room showing all columns, doors, walls and proposed equipment. Manufacturer shall not bid equipment that will not fit in available space.

C. All motor control center dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment.

D. Motor control centers shall be grounded in two places as specified on drawings.

E. Verify all accessories as shown on drawings. Perform all necessary additions and modifications to make the motor control center to the Engineer’s drawings.

F. A job-specific, custom wiring diagram for each unit shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring

diagram shall clearly show all control components connected to each unit (whether the components are mounted internal or external to the soft start enclosure). All wires and terminal blocks shall be clearly labeled. A laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated unit.

G. Operations and Maintenance Manuals and a listing of the nearest and most convenient source of replacement parts and service shall be provided to the owner for all MCC components, control wiring, etc.

H. Operations and Maintenance Manuals shall include hardcopy printouts of all device settings and programming.

I. For safety, reliability, and continuity of warranty, any modifications, alterations, etc. required to conform to the requirements of this specification shall be performed by the MCC manufacturer only. Distributor modifications, third party packaging, etc. of a manufacturer's standard product are specifically disallowed.

J. Services shall include a minimum of eight (8) hours of field/classroom training for owner's personnel on routine operation and maintenance of the specified units.

3.05 SPARE PARTS

A. The following spare parts shall be provided at no extra cost to the Owner:

1. One of each type and size of control fuse.

END OF SECTION 16443

SECTION 16461 - DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 GENERAL

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Dry Type Transformers

1.02 GENERAL REQUIREMENTS

A. Voltage for 3 phase units shall be 480V to 120/208V, three phase, four wire unless shown otherwise. Voltage of single phase units shall be 480V to 120/240V single phase, three wire unless shown otherwise.

B. Where isolation transformer is indicated on drawings, furnish K-13 rated transformer with dual-faraday electrostatic shield.

C.

PART 2 - PRODUCTS

2.01 INSULATION

A. Transformers shall be ventilated with insulation to withstand a minimum of 150 degree Celsius temperature rise (Class 220 insulation) unless specifically shown otherwise on the drawings.

2.02 ENERGY EFFICIENCY

A. Transformers shall comply with the latest applicable DOE energy efficiency requirements and latest edition of NEMA standard TP-1 and shall be labeled for the EPA Energy Star Program.

2.03 SOUND RATING

A. Sound level design may not exceed the following:

	KVA	DESIGN SOUND LEVEL
1.	0-45	40 db
2.	46-112.5	44 db
3.	113-150	47 db
4.	151-300	49 db
5.	301-750	58 db

B. Sound levels shall be determined in accordance with NEMA and ASA Standards. Core and coils shall be mounted on vibration isolator pads.

2.04 ENCLOSURES

A. Transformers mounted in dry, interior locations shall be furnished with NEMA 1 enclosures unless shown otherwise.

B. Transformers mounted outdoors or in wet locations shall be furnished with NEMA 3R enclosures with drip shields unless shown otherwise.

C. Transformers installed inside motor control centers or other similarly enclosed equipment may be “open” units not requiring additional enclosures.

2.05 CLEARANCE REQUIREMENTS

A. Transformer construction/efficiency/ventilation shall allow 3” (or less) clearance from rear and sides.

2.06 TAPS

A. All units shall be equipped with a minimum of two (2) 2 ½% taps above nominal (FCAN) and a minimum of four (4) 2 ½% taps below nominal (FCBN) as required to allow adjustment of the turns ratio of the transformer to account for site voltage adjustments.

2.07 LUGS

A. Lugs shall be AL/CU compression type suitable for the quantities and sizes of conductors required.

2.08 MANUFACTURER

A. Transformers shall be Square 'D' or Cutler Hammer.

PART 3 - EXECUTION

3.01 GENERAL

A. Minimum clearances shall be provided on all sides of transformers per manufacturer’s and code requirements.

B. Where site voltages so require, transformer taps shall be adjusted to maintain nominal voltage on secondary side of transformer. Adjustment of dry-type transformer taps shall not be made until all upstream voltage adjustments (such as voltage tap adjustments at service transformers) are finalized.

C. Refer to Specification Section 16060 for transformer grounding requirements.

D. Refer to Specification Section 16075 for transformer identification requirements.

3.02 MOUNTING

A. Transformers shall be mounted as indicated on plans. No units shall be wall mounted unless shown or directed otherwise.

B. Floor mounted transformers:

1. Shall be installed on a minimum of four (4) double-deflection neoprene vibration isolators (by Amber/Booth, Korfund Dynamics or Mason Industries - size as required – with seismic restraint capability ratings as required by the associated seismic zone).
2. Shall be installed on four-inch thick concrete pads unless specifically shown otherwise. Pad shall have beveled edges.

C. Suspended transformers:

1. Shall be trapeze-mounted on unistrut frame supported by a minimum of four steel rods and shall be mounted as high as possible or at height directed (transformers shall not be mounted above lay-in ceilings or in areas with restricted ventilation). Shall be installed using a minimum of four (4) double-deflection neoprene vibration isolators (by Amber/Booth, Korfund Dynamics or Mason Industries - size as required – with seismic restraint capability ratings as required by the associated seismic zone).
2. Contractor shall supply extra supports as may be required due to size and weight.
3. Additional seismic bracing shall be provided for suspended transformers in seismic zones as required to provide a fully code-compliant installation.

END OF SECTION 16461

SECTION 16480 - MANUFACTURED CONTROL PANELS

PART 1 - GENERAL

1.01 SCOPE

A. This section describes control stations, PLC panels, motor control panels, manufactured control panels, and other similar panels specified herein. Specifications herein are intended as an extension of requirements in other Divisions of these specifications where reference is made to Electrical Specifications.

1.02 DEFINITIONS

A. "Control Stations": Enclosures (with all required accessories) containing only door-mounted pushbuttons, indicator lights and/or selector switches (no electronic components or starter/controller equipment).

B. "Control Panels": Enclosures (with all required accessories) containing equipment/devices other than door-mounted pushbuttons, indicator lights and/or selector switches (such as electronic components, starter/controller equipment, etc.).

1.03 SUBMITTALS

A. Provide the following for each control panel:

1. A job-specific, custom wiring diagram

    a. The wiring diagram shall clearly show all components (whether the components are mounted internal or external to the control panel enclosure).
    b. All wires and terminal blocks shall be clearly labeled.
    c. Diagram shall be in accordance with NEMA/ICS standards.

2. Size, type and rating of all system components.
3. Unit frontal elevation and dimension drawings.
4. Internal component layout diagrams.
5. Manufacturer's product data sheets for all components.

B. A Bill of Materials shall be included with catalog information on all components.

C. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.

D. The following calculations shall be submitted:

1. Thermal calculations showing amount of air conditioning or ventilation and heating required for each control panel, per ambient requirements listed below and operating temperature limitations of all equipment/devices within each control panel. Where possible, forced air ventilation shall be utilized rather than

air conditioning. Panel shall be oversized, interior equipment/devices shall be derated, and solar shielding shall be provided as required to allow the use of forced air ventilation as the cooling method. Air conditioning, ventilation, and/or heating equipment shall each have ratings/capacities at least 20% larger than required by calculations below unless noted otherwise:

a. Thermal calculations used for sizing cooling/ventilation systems for each control panel located in exterior or non-conditioned spaces shall assume:

1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
2) Full solar contact where applicable (not applicable where enclosures are fully protected from solar contact using solar shields separated from panel enclosure with standoffs or similar).
3) No wind.
4) Heat loss from interior equipment (electronics, etc.) per equipment supplier's information.

b. Thermal calculations used for sizing heating systems for each control panel shall assume:

1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
2) No heat loss by interior components of control panel.
3) No solar gain on exterior of control panel.
4) Doubling of heating wattage required to account for wind where control panels are located outdoors.
5) Minimum temperature difference (due to heating) of 10 degrees F to prevent condensation, regardless of equipment temperature limitations.

2. Load calculations showing the sizing of all power supplies provided (with spare capacity as specified). Power supplies shall each have ratings/capacities at least 20% larger than required by load calculations unless noted otherwise.
3. Load calculations showing the sizing and anticipated runtime of all Uninterruptible Power Supply systems provided (with spare capacity as specified).

PART 2 - PRODUCTS

2.01 GENERAL

A. Control panels shall be Underwriters' Laboratories labeled by the panel manufacturer. Control panel manufacturers not capable of applying the U.L. label to their products are unacceptable.

B. All human interface equipment/devices (indicator lights, selector switches, pushbuttons, time switches, displays, keypads, and other similar items used for control, adjustments or monitoring) shall be mounted on the non-energized side of enclosure door(s) in such a

way as to be accessible without exposing the user to energized parts.

2.02 RATINGS

A. All Control Panels shall have short circuit current ratings at least equal to the lesser of the following, unless noted otherwise on plans:

1. The short circuit current rating of the electrical distribution equipment that feeds the Control Panel.
2. 150% of the available fault current at the Control Panel as determined by a Short Circuit Current study prepared by a licensed professional electrical engineer.

B. All equipment/devices installed within control panels shall be rated to operate in ambient temperatures of 50 degrees C (122 degrees F) or higher.

2.03 ENCLOSURES

A. All enclosures (with any required accessories or auxiliary items) shall fit within the space shown on the Plans. Any costs associated with furnishing equipment which exceeds the available space shall be borne by the Contractor.

B. Enclosures (with any required accessories or auxiliary items) shall be suitable for the environment where installed.

C. Enclosure materials shall be as follows unless noted otherwise:

1. Control Stations:

a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
b. Where located in other wet, process or outdoor areas: NEMA 4X of type 304 stainless steel construction (with stainless steel hardware).
c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 of die cast zinc/aluminum construction.

2. Control Panels:

a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
b. Where located in other wet, process or outdoor areas: NEMA 4X of type 316 stainless steel construction (with stainless steel hardware).
c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 or 12.

D. Control Panel Enclosure Construction:

1. Non-metallic control panel enclosure material, where specified, shall be reinforced polyester resin or equivalent, with a minimum thickness of 3/16 inch for all surfaces except those requiring reinforcement. Panels shall be precision molded to form a one piece unit with all corners rounded. Exterior surfaces shall be gel-coated to provide a corrosion-resistant maintenance-free satin finish which shall never need painting. Color pigments shall be molded into the resin. Color shall be grey.
2. Metallic control panel enclosures, where specified, shall be fabricated using a minimum of 14 gauge steel for wall or frame mounted enclosures and a minimum of 12 gauge for freestanding enclosures. Continuously weld all exterior seams and grind smooth. Reinforce sheet steel with steel angles where necessary support equipment and ensure rigidity and preclude resonant vibrations.
3. Use pan-type construction for doors.
4. Door widths shall not exceed 36-inches.
5. Mount doors with full length, heavy duty piano hinge with hinge pins.
6. Provide gasket completely around each door opening.
7. Mount and secure all internal components to removable back plate assembly.
8. For NEMA 1 or 12 enclosures, provide handle-operated key-lockable three point stainless steel latching system for each door.
9. For NEMA 4X enclosures, provide provisions for padlocking all doors and provide clamps on three (3) sides of each door.

E. Control panel enclosures (and associated backpanels and other similar accessories) shall be manufactured by Hoffman Engineering Co., or Saginaw Control & Engineering.

2.04 CONTROL PANEL ACCESSORIES:

A. Cooling systems shall be provided if so required by the application to maintain temperatures within the acceptable ranges of the interior equipment. In no case (regardless of temperature ratings of internal equipment) shall maximum temperatures within control panels be allowed to exceed 50 degrees C (122 degrees F). Thermostats shall be provided to control cooling without need of manual operation. Thermostat setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Cooling units shall be as manufactured by Hoffman Engineering Co., Rittal or approved equal and shall be thermostatically controlled.

B. Space heaters shall be provided for condensation and temperature control. Thermostats AND hygrostats (or combination hygrotherm controllers) shall be provided to control heating requirements (based on temperature and relative humidity within enclosure) without need of manual operation. Setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Space heaters and associated control devices shall be as manufactured by Hoffman Engineering Co., Rittal, Stego or approved equal.

C. NEMA 4X control panels shall be provided with vapor-phase corrosion inhibitor(s) (chemical combinations that vaporize and condense on all surfaces in the enclosed area, to protect metal surfaces/devices within the enclosed area from corrosion). Corrosion

inhibitor shall be Hoffman #AHCI series (sized as required by the enclosure volume to be protected) or equal.

D. For outdoor panels, stainless steel solar shields for front, top and each side of panel, supported to associated panel face with standoffs as required (to allow free air flow between solar shield and panel enclosure), shall be provided where required to limit solar loading on panel to allow use of a ventilated panel design rather than an air-conditioned panel design.

E. Provide a sun shield over all LCD displays in exterior-mounted panels. Sun shield shall be collapsible to fully protect LCD display from UV light when not in use, shall provide side and top shielding when in use, shall be constructed of stainless steel and shall be installed such as to maintain NEMA 4X ratings of enclosures.

F. Provide a clear polycarbonate gasketted hinged door or window to encompass all indicators, controllers, recorders, etc. mounted on NEMA 4 and 4X enclosures.

G. Provide interior mounting panels and shelves constructed of minimum 12 gauge steel with white enamel finish. Provide metal print pocket with white enamel finish on inside of door.

H. Provide interior LED light kit, mounted at top of interior of panel, and switched to turn "ON" when door is opened for the following control panels:

1. Control panels with outer dimensions greater than 20" wide or 30" high.
2. Control panels containing PLCs or other similar programmable devices.

I. Control panels containing VFDs or Reduced Voltage Soft Starters shall include a door mounted digital keypad for adjusting the starter parameters and viewing process values and viewing the motor and starter statuses without opening the enclosure deadfront door.

2.05 CONTROL COMPONENTS

A. General:

1. All pushbuttons, pilot lights, selector switches and other control devices shall be separate, standard size (full 30mm) and shape, heavy duty oil-tight units.

    a. Devices in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.) shall be of non-metallic construction.
    b. Devices in other areas shall be of chrome-plated construction.

2. All components and devices so that connection can be easily made and so there is ample room for servicing each item.
3. Door-mounted indicators, recorders, totalizers and controllers shall be located between 48" and 72" above finished floor level.
4. Door-mounted indicator lights, selector switches and pushbuttons shall be located between 36" and 80" above finished floor level.

5. All devices and components shall be adequately supported to prevent movement. Mounting strips shall be used to mount relays, timers and other devices suitable for this type of mounting.

B. Pilot Lights:

1. All pilot lights to be cluster LED type & push to test.

C. Pushbuttons:

1. All STOP operators within control stations located at equipment shall be provided with lockout provisions and a minimum of two (2) sets of contact blocks.
2. Emergency shutoff pushbutton devices shall be as follows unless noted otherwise:

   a. 2 ¼" diameter, mushroom-style, maintained contact push buttons
   b. With a minimum of one (1) normally open dry contact and three normally closed dry contacts.
   c. Connections made such that pushing "in" the button will shutoff the associated equipment.
   d. Provided with a red engraved nameplate with ½" lettering to read "Emergency Shutoff".

D. Relays:

1. Control relays shall have the following characteristics, unless noted otherwise:

   a. General purpose, plug-in type.
   b. Minimum mechanical life of 10 million operations.
   c. Coil voltage as indicated or required by application.
   d. Single-break contacts rated 12 amperes, resistive at 240 volts.
   e. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each individual relay shall have 3PDT contacts. Where required, multiple control relays shall be provided (to provide the required quantities of contacts) for each "relay" function shown on plans/diagrams.
   f. Furnished with RC transient suppressor to suppress coil-generated transients to 200% of peak voltage.
   g. LED on/off indicator light and manual operator.
   h. Industry standard wiring and pin terminal arrangements.
   i. Equal to Square D 8501KP series with matching plug-in socket.

2. Interposing/isolation relays used to isolate discrete output field wiring (and where required for voltage translation for other discrete signals) to/from PLC inputs/outputs shall be terminal-block style. Terminal-block style relays shall have the following characteristics, unless noted otherwise:

   a. Minimum mechanical life of 10 million operations.

b. Single-break contacts rated 6 amperes, resistive at 120 volts.
c. One (1) N.O. contact per relay.
d. Furnished with integral transient protection.
e. LED on/off indicator light.
f. DIN-rail mounted.
g. Equal to Square D type Zelio RSL.

3. Timer relays shall be electronic, adjustable plug-in devices meeting the following characteristics, unless noted otherwise:

a. General purpose, plug-in type.
b. Minimum mechanical life of 10 million operations.
c. Single-break contacts rated 10 amperes, resistive at 240 volts.
d. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each relay shall have DPDT contacts (2 N.O. & 2N.C.). Where required, multiple timer or control relays shall be provided (to provide the required quantities of contacts) for each "relay" function shown on plans/diagrams.
e. Rotary-thumbwheel adjustments for time value, timing range and function.
f. Time value adjustments from .05 seconds to 999 hours
g. Selectable Timing Functions, including the following:

1) On Delay
2) Interval
3) Off Delay
4) One Shot
5) Repeat Cycle-Off
6) Repeat Cycle-On
7) On/Off Delay
8) One Shot Falling Edge
9) Watchdog
10) Trigger On Delay

h. Accuracy shall be $\pm$ 2% and repeatability shall be $\pm$ 0.1%.
i. Furnished with integral transient protection.
j. LED indicator light(s) for "timing" and "on/off status"
k. Held in place with hold-down spring
l. Equal to Square D type JCK with matching plug-in socket.

2.06 CONFORMAL COATINGS

A. All printed circuit boards within electronic devices (PLCs, RTUs, controllers, I/O modules, power supplies, touchscreens, Ethernet switches, radios, etc.) installed in panels located in non-conditioned or exterior/process areas shall be conformal-coated for harsh environments.

2.07 DC POWER SUPPLIES

A. DC Power supplies shall be provided where specified elsewhere, or as required by design

of system. Power supplies shall be industrial type, AC-to-DC switching, output voltage as required, 120vac input, size as required for the initial application plus 50% spare capacity.

B. Redundant power supplies with diode isolation shall be provided so that the loss of one power supply does not affect system operation. The back-up supply systems shall be designed so that either the primary or the back-up supply can be removed, repaired, and returned to service without disrupting the system operation.

C. Power supply output shall be protected by secondary overcurrent protection device(s).

D. The power distribution from multiloop supplies shall be selectively fused so that a fault in one instrument loop will be isolated from the other loops being fed from the same supply.

E. Each power supply shall meet the following requirements.

1. Regulation, line: 0.4% for input from 105 to 132vac.
2. Regulation, load: 0.8%
3. Ripple/Noise: 15mV RMS / 200 mV peak to peak
4. Operating temperature range: 0 deg C - 60 deg C
5. Overvoltage protection
6. Overload Protection
7. Output shall remain within regulation limits for a least 16ms after loss of AC power at full load.
8. Output status indicator.
9. UL listing

F. Power supplies shall be manufactured by Puls, Sola, Phoenix Contact or equal.

2.08 UNINTERRUPTIBLE POWER SUPPLIES

A. Uninterruptible power supplies (UPSs) shall be provided where specified elsewhere, or as required by design of system. Power supplies shall be industrial type, size as required for the initial application plus 50% spare capacity unless noted otherwise.

B. Battery runtime shall be as specified elsewhere. If no other specification for battery runtime is specified, battery runtime shall be 12.5 minutes at full load.

C. UPSs shall be double-conversion, on-line type.

D. UPSs shall be rated for operation in -20 degrees C to 55 degrees C ambient temperatures.

E. UPS batteries shall be hot-swappable and 12-year rated when installed in 25 degrees C environment and 4-year rated when installed in 50 degrees C environment.

F. UPSs shall include dry contacts for the following alarm points:

1. Loss of Input Power Alarm
2. Low Battery Alarm

G. UPSs shall be manufactured by Falcon UPS or approved equal.

2.09 DISCONNECTS

A. A main disconnect switch or circuit breaker shall be supplied integral to all control panels. The main disconnect or circuit breaker shall be accessible/operable without exposing the operator to energized sections of the control panel(s), and shall be lockable in the open/off position.

B. Individual circuit breakers shall be provided integral to the manufactured control panel for each separate power circuit originating within the control panel.

C. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.

D. Manufacturers:

1. Square 'D' or Cutler Hammer.

2.10 COMBINATION STARTERS

A. All combination starters shall utilize a unit disconnect. Magnetic starters shall be furnished in all combination starter units unless specifically shown otherwise. All starters shall utilize full NEMA/EEMAC rated contactors (size 1 minimum).

B. Starters shall be provided with a three-pole, external (door mounted) manual reset, solid state overload relay. Solid state overload relay shall have switch-selectable trip class and shall provide protection from:

1. Overload.
2. Phase Unbalance.
3. Phase Loss.
4. Ground Fault (Class II detection).

C. Unless specifically shown otherwise, each combination starter or each group of starters shall be furnished with a control circuit transformer including two primary protection fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads (including motor space heaters and other similar loads where specified). The transformer rating shall be fully visible from the front when the unit door is opened. Unless otherwise indicated, control voltage shall be 120V AC. Control power shall be provided by individual unit control power transformers.

D. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.

E. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

F. NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.

G. Each starter shall be equipped with a minimum of the following control devices:

1. Door-mounted reset button.
2. Two (2) field-reversible (N.O./N.C.) auxiliary contacts
3. For reversing and two-speed starters: Four (4) field-reversible (N.O./N.C.) auxiliary contacts
4. Additional control devices as indicated on plans.

H. Control Wiring Terminal Blocks

1. Terminal blocks shall generally be:

a. Feed-thru, screw-in type
b. DIN rail mounted
c. Furnished with the stationary portion of the block secured to the unit bottom plate
d. Furnished with unit-mounted control terminal blocks for each field wire.
e. Rated for the voltage and current of the proposed application per UL/NEC standards.
f. Sized (by supplier) for the associated wire gauges/types/quantities.
g. Phoenix Contact UT-4 series, Weidmuller WDU-4 series (or equivalent) unless required otherwise by application.

I. Nameplates

1. Each unit shall be properly labeled with an engraved phenolic nameplate with a white background and black letters.
2. Each pilot device shall be properly labeled with a legend plate or an engraved phenolic nameplate.

J. Manufacturers:

1. Square 'D' or Cutler Hammer.

2.11 WIRING

A. Refer to Section 16120 for all wiring types/applications.

B. All wiring shall be identified on each end with hot stamped, shrink tube type, or self-laminating vinyl permanent wire markers to correspond with numbering shown on wiring diagrams.

C. All connections shall be made on terminals with no splices.

D. All wiring runs shall be along horizontal or vertical routes to present a neat appearance. Angled runs will not be acceptable. Group or bundle parallel runs of wire in plastic wire duct where practical.

E. All wiring runs shall be securely fastened to the panel or wire duct by means of plastic wire ties. Adequately support and restrain all wire runs to prevent sagging or movement.

F. AC power wiring and instrumentation/analog wiring shall be run separate.

G. Color code all internal wiring (not field wiring) as follows:

1. Line and load circuits: Black (B)
2. AC control wiring: Red (R)
3. Externally-Powered control wiring: Yellow (Y)
4. Neutral wiring: White (W)
5. Low voltage DC(+)pos: Blue (BL)
6. Low voltage DC(-)neg: Blue/White Tracer (BL/W)
7. Grounding: Green (G)

H. Terminal strips shall be provided for all input and output wiring. No more than two (2) wires shall be connected to one (1) terminal block.

2.12 ELECTRICAL SURGE AND TRANSIENT PROTECTION

A. General

1. Function: Protect the system against damage due to electrical surges.

B. Application: As a minimum, provide surge and transient protection (with proper grounding) at the following locations as described below:

1. Power Input High Frequency Noise Filtering:

a. 120VAC Control panels with integral UPSs, PLCs, or other electronic/microprocessor equipment that is susceptible to failure or improper operation due to high frequency/harmonic input transients shall be provided with series-connected high-frequency noise filters on the line input (downstream of any panel main disconnects/breakers). Filters shall be as manufactured by Edco/Emerson/Islatrol or equal (exact type(s) as required by application).

2. Power Input Surge Protection:

a. Provide surge protection device at any connection of 120VAC power to panels containing programmable logic controllers, remote I/O equipment, UPS’s, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:

1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
2) Be of two-part (base and SPD), DIN-rail mountable construction.
3) Have 15kA total nominal discharge current per line (based on 8/20µs waveform).
4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
5) Visually indicate operational status.
6) Be Dehn DEHNguard series or equal by MTL Technologies, or may be combined with the High Freqency Noise Filtering device required above.

b. Provide surge protection device at any connection of multi-pole AC power to panels containing programmable logic controllers, remote I/O equipment, UPS's, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:

1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
2) Provide protection for all phases.
3) Have 40kA (per phase) peak surge current rating.
4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
5) Visually indicate operational status.
6) Be Square D SDSA or HWA series or equal.

3. Analog I/O Panel Terminations Surge Protection:

a. Provide surge protection device at the PLC (or similar) panel connection of each analog I/O signal. Device shall:

1) Be mounted internal to the associated panel.
2) Be of two-part (base and SPD), DIN-rail mountable construction.
3) Have 10kA total nominal discharge current per line (based on 8/20µs waveform).
4) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal.
5) Be Dehn Blitzductor XT series or equal by MTL Technologies.

4. Discrete I/O Panel Terminations Surge Protection:

a. Provide isolation relay at the PLC (or similar) panel connection of each discrete output signal (within the associated panel). See above for isolation relay requirements.

5. Low Voltage Power Supply Load Side Surge Protection:

a. Provide surge protection device at the PLC (or similar) panel on the load side of each low voltage power supply that has low voltage connections extending external to the panel. Device shall:

1) Be mounted internal to the associated panel.
2) Be of two-part (base and SPD), DIN-rail mountable construction.
3) Have 10kA total nominal discharge current per line (based on 8/20µs waveform).
4) Have maximum continuous operating voltage (MCOV) rating as required by the associated utilization voltage.
5) Be as manufactured by Dehn, MTL Technologies, or Phoenix Contact.

6. Network Panel Terminations Surge Protection:

a. Provide surge protection device at the PLC (or similar) panel connection of each network cable. Device shall:

1) Be mounted internal to the associated panel.
2) Be of DIN-rail mountable construction.
3) Have 1kA total nominal discharge current per line (based on 8/20µs waveform).
4) Be designed specifically for the associated network connection type (Ethernet, RS485, RS232, etc.).
5) Be MTL Zonebarrier series or equal.

7. Antenna Cable Terminations Surge Protection:

a. Provide surge protection device at the connection of antenna cable to the radio panel. Device shall:

1) Be mounted internal to the associated panel.
2) Provide coarse protection via replaceable gas-filled surge voltage arrestor
3) Be Phoenix Contact CN-LAMBDA series or equal.

C. Installation and grounding of suppressor: As directed by manufacturer. Provide coordination and inspection of grounding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide enclosure mounting supports as required for floor, frame or wall mounting. All supports in exterior, wet or process areas shall be stainless steel unless noted otherwise. All floor-mounted panels or other similar distribution equipment shall be mounted on 6" concrete housekeeping pads unless specifically shown otherwise.

B. All enclosures used outside shall be solid bottom unless otherwise specified. All cable

and piping openings shall be sealed watertight. Cable and piping shall enter the enclosure as shown on drawings or specified herein.

C. All equipment and components shall be solidly grounded to the control panel. One grounded terminal unit shall be provided in each control panel for connection to plant ground system. Grounding digital and analog components shall be performed in accordance with the instrument supplier's installation recommendations. Signal ground shall be solidly connected to the ground system so as to prevent ground loops

3.02 PAINTING

A. For enclosures other than NEMA 4X stainless steel or fiberglass:

1. Completely clean all surfaces so that they are free of corrosive residue. Then, phosphatize all surfaces for corrosion protection.
2. Prime with two (2) coats and finish with one coat of factory finish textured polyurethane. Paint shall be Sherwin-Williams Polane "T' or approved equal.
3. Color to be selected during shop drawing review phase.

3.03 IDENTIFICATION & DOCUMENTATION

A. Refer to specification section 16075 for additional requirements.

B. Control panel power supply source, type, voltage, number or circuit ratings shall be identified inside control panels and on drawings.

C. All interior devices and components shall be identified with thermal transfer labels with black letters on white background. Labels shall be placed on the subpanel and not the component. Marking system shall be a Brother "PTouch II" or equal. Lettering shall be 1/4" high.

D. All front panel mounted devices such as push buttons shall be identified by the use of engraved bakelite nameplates or legend plates. Nameplates shall be 1/8" thick, white with black core.

E. Where a panel includes a PLC or other network-connected device that is intended to be connected to another system (such as a plant SCADA system) via a network connection, the panel supplier shall provide an Interface Control Document (ICD) to the other system supplier (such as the SCADA Integrator). This document shall itemize the following for each networked parameter that is capable of being monitored or controlled by the other system:

1. Parameter Name/Function (ex: Pump No. 1 On/Off Status)
2. Parameter Type (discrete or analog, input or output)
3. Parameter register ID/location

F. Where a panel includes a touchscreen or other programmable HMI display and is to be monitored by another system (such as a plant SCADA system), the panel supplier shall provide copies of the HMI display code and screenshots of all proposed HMI screens to

the other system supplier (such as the SCADA Integrator) for their use in duplicating the associated HMI.

G. A job-specific, custom wiring diagram for each control panel (not including control stations without relays) shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring diagram shall clearly show all control components connected to the panel (whether the components are mounted internal or external to the enclosure). All wires and terminal blocks shall be clearly labeled. A laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated panel, and submitted to the owner with the as-built documentation.

3.04 OWNER TRAINING

A. Fully train the owner in the proper operation of all control panels/equipment, describing and demonstrating full operation, including function of each door-mounted device.

3.05 SPARE EQUIPMENT

A. Provide the following spare equipment:

1. Fuses: 10% (minimum of 3) of each size and type utilized, mounted within a pocket within the associated control panel.
2. Where control panel contains programmable controller (or similar equipment): Flash drive containing copies of all final programs utilized within the control panel, with provisions/cable assemblies as required to connect the flash drive provided to the controller to download the programs. Flash drive shall be attached to retractable cord (long enough to reach the associated port) attached to the inside of the panel door.

END OF SECTION 16480

SECTION 16491 - FUSES

PART 1 - GENERAL

1.01 GENERAL

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Fuses

PART 2 - PRODUCTS

2.01 FUSES

A. Fuses - 600 volts and less - shall be furnished and installed by electrical contractor who will maintain fuses in original new condition until installed. Fuses shall not be installed until equipment is ready to be energized.

B. Fuses 601 to 6000 amperes shall be time-delay, Class L type with an “O” ring to provide seal between the end bells and the glass melemine fuse barrel. Terminals shall be penned. Fuses must hold 500% rating for a minimum of 4 seconds and clear 20 times rated current in .01 seconds or less. Fuses shall be current-limiting and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. Bussmann Hi-Cap, time-delay, Class L fuses.

C. All other fuses for power, light and motor circuits shall be dual-element, Class RK5 type with separate overload and short-circuit elements. The overload element shall incorporate a spring activated thermal unit having a 284 Degree Fahrenheit melting point alloy and with a heat sink that will provide time-delay of a minimum of 10 seconds at 500% rating. Fuses shall be current-limiting and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. Bussmann Low-Peak, dual-element, Class RK5 fuses.

D. Fuses shall be installed in fluorescent fixtures on the line side of the ballast by the fixture manufacturer who will size the fuses for each application. Bussmann GLR fuses installed in HLR fuseholder.

E. Fuses for all other ballast-controlled lighting fixtures shall have fuses installed on the line side of the ballast either in the housing or handhole of lighting standards for easy access. Bussmann FNQ fuse with HPF holder for all applications. Bussmann FNQ fuse with HPF holder for all applications except lighting Standards where Bussmann HEB-JJ holder with FNQ fuse will be used.

2.02 MANUFACTURER

A. Fuses shall be as manufactured by Bussmann Manufacturing or approved equal. Approved substitutions will be allowed that provide required electrical safety overload and short-circuit performance. Electrical contractor shall submit one copy each of fuse

and fuse holder manufacturers bulletins that fully describe performance for substitution approval consideration. The bulletins shall be submitted to the Electrical Design Engineer at time of bid submittal.

PART 3 - EXECUTION

3.01 SPARE FUSES

A. Spare fuses shall be provided by the electrical contractor. 10% (minimum of 3) of each size and type will be placed in a Spare Fuse Cabinet mounted on the wall of the electrical room.

END OF SECTION 16491

SECTION 16511 - LIGHTING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Lighting Fixtures

B. Drivers

1.02 SUBMITTALS

A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicated that the contractor/supplier intends to meet all contract requirements. Refer to specification section 16050 for additional requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.

B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.

C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor’s expense.

D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

2.02 LED LUMINAIRES

A. For the purpose of these specifications, LED Luminaires shall be defined as the entire

LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the lighting fixture.

B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.

C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.

D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.

E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail "open" such as to prevent fixture operation after a surge protection failure.

F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.

G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

2.03 STEMS/PENDANTS

A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.

B. Stems/Pendants shall be rigid conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.

C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.

D. Shall be painted the same color as the fixture trim unless noted otherwise.

2.04 MANUFACTURER

A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.

B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF LIGHTING FIXTURES

A. Support:

1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.
2. Contractor shall coordinate installation requirements for all wall-mounted fixtures (especially for wall-mounted fixtures on uneven wall surfaces, etc.) as required to assure a level/flat mounting surface and level/plumb/secure finished installation. Contractor shall provide flat mounting plates or other mounting provisions where necessary. Any proposed mounting plates, etc. shall be submitted to and approved by project architect prior to ordering materials.
3. Fixtures shall be supported independent of ceiling from structural members of building.
4. Pendant mounted fixtures shall be directly supported from the structure above using a 9 gauge hanger wire or an approved alternate support without using the ceiling suspension system for direct support.
5. Tandem fixtures may utilize common hanger wires.
6. Contractor shall submit typical hanging detail to Engineer before installing any fixtures.

B. Connections:

1. All grid fixtures shall be wired by flex individually to junction and not wired fixture to fixture.
2. All flex shall contain 3 conductors (3rd wire ground). Ground wire shall be securely grounded at each end. Other conductors shall be connected by approved connectors.

C. Row-Mounted fixtures:

1. All stems on row-mounted fluorescent fixtures shall be installed as follows (except fixtures with slide grip hangers):

    a. One stem shall be installed in the first fixture knockout from end of row (on the first and last fixture of the row).
    b. One stem shall be installed between each two fixtures. Stem shall center joint where fixtures join and shall attach by use of "joining plates".
    c. All fixtures in continuous rows other than recessed grid type shall be connected by nipples with locknuts bushings.

2. Coordination:
3. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to insure proper fit and coordination with other trades.
4. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 16511

SECTION 16850 - ELECTRICAL HEAT TRACING SYSTEMS

PART 4 - GENERAL

4.01 SCOPE

A. This specification covers the requirements of materials and support services for heat-tracing systems. Heat tracing systems (including insulation and all accessories) shall be provided on all piping installed exposed in exterior locations or where otherwise indicated on plans unless noted otherwise.

4.02 CODES, APPROVALS, AND STANDARDS

A. The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.

1. ANSI American National Standards Institute
2. CEC Canadian Electrical Code
3. CSA CSA International
4. FM FM Approvals
5. IEC International Electro-Mechanical Commission
6. IEEE Institute Of Electrical and Electronics Engineers
7. ITS Intertek Testing Services (Intertek ETL SEMKO)
8. NEC U.S. National Electrical Code (NFPA 70)
9. NEMA National Electrical Manufacturers Association
10. NESC National Electrical Safety Code
11. UL Underwriters' Laboratories, Inc.

PART 5 - PRODUCTS

5.01 ACCEPTABLE MANUFACTURERS

A. Heat Tracing:

1. Raychem/Tyco Thermal Controls.
2. Thermon.
3. Nelson Heat Tracing.
4. Chromalox.

B. Insulation:

1. Armstrong World Industries, Inc.
2. Babcock & Wilcox; Insulationg Products Division
3. CertainTeed Corporation
4. Knauf Fiber Glass GmbH
5. Manville Products Corp.
6. Owens-Corning Fiber Glass Corp.

7. Pittsburg Corning Corp.
8. Rubatex Corp.

5.02 SELF-REGULATING HEATING CABLES

A. All heat-tracing applications with continuous exposure (maintain) temperatures from 150°F (65°C) to 250°F (121°C) or intermittent exposure temperatures from 185°F (85°C) to 420°F (215°C) shall use self-regulating cables.

1. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
2. Self-regulating heating cable shall be designed for a useful life of 20 years or more with "power on" continuously, based on the following useful life criteria:

    a. Retention of at least 75 percent of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.
    b. Retention of at least 90 percent of nominal rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 746B, IEC 216-1 Part 1.

3. A warranty against manufacturing defects for a period of 10 years shall be available.
4. All cables shall be capable of passing a 2.5 kV dielectric test for one minute (ASTM 2633) after undergoing a 0.5 kg-m impact (BS 6351, Part 1, 8.1.10).

5.03 FREEZE-PROTECTION SYSTEMS

A. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.

B. The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.

C. In order to provide rapid heat-up, to conserve energy, and to prevent overheating of fluids and plastic pipe, the heating cable shall have the following minimum self-regulating indices:

1. Table K.1 Minimum Self-Regulating Indices

Heating cable	S.R. index (W/°F)	S.R. Index (W/°C)
3 W/ft	0.038	0.068
5 W/ft	0.060	0.108
8 W/ft	0.074	0.133
10 W/ft	0.100	0.180

D. The self-regulating index is the rate of change of power output in watts per degree Fahrenheit or watts per degree Celsius, as measured between the temperatures of 50°F (10°C) and 100°F (38°C) and confirmed by the type test and published data sheets.

1. In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self-ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30 minutes. After this test, if the cable is reen-ergized, it must not have an increasing power output leading to thermal runaway.
2. In order to confirm 3.1B, the self-regulating heating cable shall retain at least 90 percent of its original power output after having been cycled 300 times between 50°F (10°C) and 210°F (99°C), allowing at least six minutes of dwell time at each temperature.
3. The heating cable shall be Raychem® BTV-CT or BTV-CR self-regulating heater, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.

5.04 SYSTEMS FOR DIVISION 1 HAZARDOUS LOCATIONS

A. The following requirements shall apply in addition to the criteria specified above:

1. The self-regulating heating cable shall be specifically FM Approved or CSA Certified for use in Division 1 locations.
2. A ground-fault protection device set at 30 mA, with a nominal 100 ms response time, shall be used to protect each circuit.
3. The temperature identification number (T-rating) of the cable used shall comply with FM and CSA requirements as applicable.
4. Connection methods used with the cable shall be compatible and approved as a part of the system manufactured and supplied by the heating cable vendor for use in the Division 1 location.
5. For plastic pipe and vessel applications, the heating cable shall be Raychem HBTV-CT or Raychem BTV-CT self-regulating heaters, with continuous exposure capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.
6. The heating cable shall be Raychem HQTV-CT or Raychem QTVR-CT self-regulating heaters, for continuous and intermittent exposure capability up to 225°F (110°C), as manufactured by Tyco Thermal Controls.

B. Terminations for nonhazardous And hazardous class 1, div 2 locations

1. All connection components used to terminate heating cables, including power connectors, splices, tees, and connectors shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no cir-cumstances shall terminations be used which are manufactured by a vendor other than the cable manufacturer.
2. In order to keep connections dry and corrosion resistant, components shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated NEMA 4X. The component stand shall allow for up to four inches (100 mm) of thermal insulation.

3. Terminals shall be spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.
4. Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.
5. Components shall be rated to a minimum installation temperature of –40°F (–40°C), minimum usage temperature of –75°F (–60°C), and maximum pipe temperature of 500°F (260°C).
6. The component system shall be Raychem JBM-100-L-A connection kit complete with integral LED power indicating light to serve as complete power, splice, or tee connection for up to three Raychem BTV, QTVR, or XTV industrial parallel heating cables as manufactured by Tyco Thermal Controls.

5.05 THERMOSTATS AND CONTACTORS

A. Freeze protection systems shall operate using self-regulating control or with the DigiTrace AMC-1A or DigiTrace AMC-F5 thermostat and the DigiTrace E104-100A or DigiTrace E304-40A contactor in nonhazardous locations, and DigiTrace AMC-1H thermostat with Digitrace E307-40A contactor in hazardous locations, as supplied by Tyco Thermal Controls.

B. Where heat tracing is applied to emergency showers and/or emergency eye wash systems (or other systems where the heated piping system provides water that may be applied to persons in emergency or non-emergency situations), the sensor (that determines whether the heat tracing system is ON or OFF) shall be placed on the associated pipe or tank wall rather than in ambient air (such as to prevent the heat tracing system from overheating the associated liquid).

5.06 END SEAL

A. An above-insulation, lighted end seal kit shall be provided for each heat trace circuit termination as per the manufacturer’s installation details. The kit shall be E-100-LBTV2 as supplied by Tyco Thermal Controls.

5.07 INSULATION

A. All components of the insulation, including covering, mastics and adhesives shall have a flame-spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards. The integrated insulation assemblies shall also conform to the above specifications. Insulation shall be applied in strict accordance with the manufacturer's instructions.

B. Description:

1. This type of insulation shall be employed for process, cold-and hot water, steam, and condensate piping and equipment with surface temperatures up to 850 degrees F. Pipe insulation and jacketing shall be applied to piping where shown, and shall include fittings, flanges, and valves. Pipe insulation shall be molded-type pipe covering, made of

fibrous glass with a minimum k-factor of 0.23 at 75 degrees F mean temperature. Unless otherwise specified the insulation thickness shall be 1" minimum.

2. The insulation shall be oversized for installation over electric heating cable. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Insulation shall be coordinated with the pipe hangers and supports and where insulation protection shields are provided the top half section of pipe insulation at support locations shall be of the same specified density, and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb/cu ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic preformed jacketing with a factory attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and protect the insulated fitting. Each section shall be manufactured from aluminum or PVC, and all joints shall be sealed with silicon mastic or solvent welding, to provide a continuous, air and weathertight joint. Strapping shall be 1/2-inch wide, Type 3003 aluminum or stainless steel.

PART 6 - EXECUTION

6.01 GENERAL

A. Heat tracing shall be provided along full length of all exposed piping or vessels located outside of buildings or in other areas designated on plans (such as by insulated piping in areas subject to cold temperature). Insulation shall be provided over all heat traced pipes.

B. The vendor shall provide a detailed design utilizing standard heat-tracing design software, such as Tyco Thermal Controls TraceCalc® Pro design software or equal. At minimum, the design must provide the following:

1. Circuit identification number
2. Maintain temperature
3. Line size and insulation
4. Heat loss for pipe, valves, and supports
5. Amount and type of heating cable required
6. Spiral requirements
7. Heating cable service voltage
8. Heating cable power output at the maintain temperature
9. Minimum and maximum maintain temperature vs. minimum and maximum ambient temperatures
10. Circuit breaker and transformer sizing

C. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.

D. Install additional heating tape at bolted flanges, valves, pipe supports, and other fittings and fixtures as recommended by supplier, but not less than the following:

1. Bolted flanges (per pair): Two times pipe diameter
2. Valves: Four times valve length
3. Pipe hanger or support penetrating insulation: Three times pipe diameter

E. The entire system shall be installed in compliance with the manufacturer's recommendations for a fully-functional, code-compliant system.

F. All insulation shall be installed by a qualified insulation contractor in strict accordance with the manufacturer's recommendations and the requirements of these specifications.

G. All piping insulation shall be installed following required testing and approval of piping.

6.02 IDENTIFICATION

A. Heat tracing systems shall be labeled at the field connection of power to the heat tracing equipment per the requirements for Utilization Equipment within Specification Section 16075.

B. Heat traced piping, vessels, etc. shall be identified with appropriate caution signs or markings at intervals not exceeding 20 feet on center per NEC requirements.

6.03 TESTING

A. Factory inspections and tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following:

1. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
2. In the field, all heater cables shall be meggered. The following separate field megger readings shall be taken on each self-regulating and each M.I. heater cable:

    a. Heater cable shall be meggered when received at jobsite before installation.
    b. Heater cable shall be meggered after installation, but before insulation is applied.
    c. Heater cable shall be meggered after insulation has been installed.

3. All three of the above field megger readings shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.
4. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the user.

END OF SECTION 16850

SECTION 16905 - INSTRUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide a complete system of instrumentation and controls with appurtenant equipment and accessories as indicated, specified, and as necessary for a complete and proper operating system.

1. Work includes, but not necessarily limited to, the following:

a. All engineering, hardware and software development, installation, startup, ranging, calibration services and supervision necessary.
b. Testing and operational demonstrations as specified.
c. Training programs as specified.
d. Preparation of manuals.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Specifications, Special Provisions, and all other related Sections.
2. Refer to Specification Section 16900 for additional SCADA System requirements.
3. Refer to plans for point lists and additional device requirements.

1.02 QUALITY ASSURANCE

A. Where not specifically allowed or required otherwise by contract documents, all instrumentation and related equipment specified within this section shall be furnished by the Contractor’s Instrumentation Integrator for the project for proper system coordination.

B. Contractor:

1. Shall be fully and solely responsible for the work of the systems supplier and solely responsible to the Owner for having supplied to the Owner the complete integrated system.
2. To provide personal superintendence and direction of the work, maintaining and supplying complete supervision over and coordination between all subcontractors employed by him and the Instrumentation and Control System Integrator.
3. To be responsible for defining the limits of his subcontractor's work.
4. To be responsible for setting of instruments (including alarms, etc. as provided under other sections).

C. Provide Operation and Maintenance manuals

1. Operating instructions shall incorporate a functional description of the entire system, including the system schematics which reflect “as-built” modifications.

2. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.
3. As part of the operation and maintenance manuals, provide one hard copy of the program used to program the programmable logic controller.

1.03 WARRANTY

A. Systems supplier shall furnish a hardware and software warranty for the system starting at substantial completion and ending one year from this date.

1.04 REFERENCES

A. Instrument Society of America (ISA) PR7. 1, Pneumatic Control Circuit Pressure Test, Tentative Recommendation Practice.

B. Instrument Society of America (ISA) S5.4, Instrument Loop Diagrams, standard.

C. National Electrical Manufacturers Association (NEMA) Publication, General Standards for Industrial and Control Systems, ICS 1 and Industrial Controls and Systems ICS2.

1.05 SUBMITTALS

A. General/System submittal requirements:

1. Provide submittal (quantity as required by contract) of:

a. Component manufacturing data sheets indicating pertinent data and identifying each component (including all instruments, surge protection devices, antennae, sun/rain shields, etc.) by tag number and nomenclature as indicated on drawings and in specifications.
b. Component drawing showing dimensions, mounting, and external connection details,
c. List of all spare parts. All manufacturers recommended spare parts shall be provided in addition to required spare parts.

2. Identify any specification section where exceptions are being taken or an "or equal" piece of hardware is being proposed.
3. A Bill of Materials shall be included with catalog information on all components.
4. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.

B. Instrumentation/Field Device submittal requirements:

a. Manufacturer’s product data sheets
b. Job-specific model numbers for each instrument/field device
c. Job-specific ranges/setpoints/etc. proposed for each instrument/field device

1.06 DELIVERY, STORAGE AND HANDLING:

A. Packing and Labeling:

1. Prior to shipment, each component shall be tagged to identify its' location, tag number, and system function. Identification shall be prominently displayed on the outside of the package.
2. Firmly attach permanent stainless-steel, or other durable non corrosive tag to the equipment. Mark tags with the instrument tag number shown in the Instrumentation Data Sheets and/or Instrument drawings.

B. Delivery:

1. Following completion of shop assembly, factory test, and successful submittal of all equipment information (without requirement for resubmittal), equipment shall be shipped. Provide protection for equipment from handling and the environment.

C. Receiving:

1. The contractor is responsible for receiving and proper storage of equipment delivered to the job site.
2. All received items shall be protected from the elements and where required stored in a low humidity environment.
3. Protect materials and equipment against damage in storage and during construction.

PART 2 - INSTRUMENTATION

2.01 GENERAL

A. All equipment and materials shall be new, unused and proved by previous use of similar products to be completely suitable for the service intended.

B. All of the equipment shall be the manufacturer’s latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the system. All accessories, hardware, etc. shall be provided as required for a fully functional system. The completed system shall be compatible with the functions required and other equipment furnished by the Contractor.

C. All electrical components of the system shall be powered by 120V, single phase, 60 cycle current or 24VDC loop-powered from control panel, except as otherwise indicated or specified.

D. Cable lengths between sensors/elements and associated transmitters shall be as required by application. Contractor shall coordinate lengths and types of all sensor cables with the associated sensor supplier prior to bid and shall provide cable lengths/types as required.

2.02 LEVEL (OR OPEN CHANNEL FLOW) TRANSMITTERS & ULTRASONIC TRANSDUCERS

A. General:

1. Scope -This section describes the requirements for a 4-wire, multi-functional ultrasonic level/open channel flow transmitter system.
2. Basic System Description

    a. The multi-functional level control system (level system) shall employ acoustic echo-ranging technology to determine the distance between the transducer(s) and monitored surface(s), as a basis for display, output, and digital communication.
    b. The level/flow monitoring system shall consist of a microprocessor based level transmitter and one or two ultrasonic transducers.
    c. The level/flow transmitter shall be operator configurable to meet specific application requirements by implementation of available signal processing and process control functions, in any allowable combination.

B. Technical Specifications:

1. Signal Processing - The level transmitter shall:

    a. Employ ultrasonic transceiver(s) suitable for providing excitation to, and processing resultant signals from the attached ultrasonic transducer(s).
    b. Create a digitized echo profile, and apply patented Sonic Intelligence echo processing techniques to select and verify the echo representing the reflective surface monitored.
    c. Calculate the distance between the transducer face and reflective surface based on the echo selected. The calculated distance may be converted to represent: material level, differential level, average level, space, material volume, vessel ullage, pumped volume, or head, open channel flow rate, and/or total flow volume.
    d. Compensate temperature-induced variation in the acoustic wave propagation velocity in air. This compensation shall be based on signals received from the ultrasonic transducer(s) and/or a TS-3 temperature sensor.
    e. Include a calibration method and/or enable manual operator value entry, to set a fixed acoustic wave propagation velocity for transmission mediums other than air.
    f. Include configuration and calibration ability via integral keypad with non-volatile EEPROM memory to store user-programmed configuration.
    g. Display measured variable (level/flow) on the main backlit LCD display along with associated units.

2. Process Control Functions - The level transmitter shall provide an assortment of process control functions that may be user implemented in any allowable combination.

    a. Standard Process Control Functions

1) 0/4–20 mA output directly / inversely proportional to level, space, flow or distance
2) Level alarm(s) based on on/off setpoints
3) Loss of Echo or Cable Fault alarm
4) Duty assist pump operation based on fixed or alternating level setpoints
5) Remote relay state control via communications
6) Basic failsafe operation on measurement loss
7) Discrete inputs configurable to override level transmitter I/O operations

3. User Interface - The level transmitter shall enable user access to read only and read/write enabled data, using any of the following methods:

a. Direct or scroll access to data stored in numerical parameters, using the hand programmer and graphic LCD display.
b. IBM PC compatible computer access to data and digital echo profiles, using the Dolphin Plus instrument configuration package.
c. HMI, SCADA, PLC, or DCS system access to data stored in Modbus registers via digital communications.

4. Detailed Specifications:

a. Power

1) 100-230 VAC ± 15%, 50 / 60 Hz, 50VA or less

b. Enclosure

1) Polycarbonate/Polyester, Indoor/Outdoor
2) NEMA 4X / IP 65

c. Ambient Temp.

1) -20 to 50°C (-5 to 122°F)

d. Display

1) Back lit LCD, multi-line display

e. Process Control I/O - The level transmitter shall provide:

1) One (1) 4-20mA HART analog signal output, directly or inversely proportional and scalable to the configured process variables, (dependent upon the transmitter model), capable of driving a 750 ohm load.
2) A minimum of three (3) form C relays with contact outputs based on the level conversion or other process variable as set by the Relay Function and other user configurable relay parameters.

3) Two discrete inputs that may be configured to override normal Process Control Functions.
4) One (1) 4-20mA input (model dependant) that may be scaled to a monitored process variable, to be used as a basis for level transmitter Process Control Functions.

f. Ranges: As directed by Civil Engineer.

5. Accessories:

a. Stainless steel mounting bracket/hardware as recommended by manufacturer.

6. Spare Parts:

a. Provide one (1) spare transducer of each type furnished with manufacturer's cable length to match longest cable length furnished within project.

7. Execution:

a. Maintain minimum separation between transducer and maximum process material level as recommended by manufacturer.
b. Mount transducer to ensure a clear path from the transducer to the process material surface.
c. Where required by the application, provide submergence shield for the transducer(s).

C. Manufacturer/ Model:

1. Pulsar Ultra 5 series transmitter with dB Ultrasonic Level Transducer(s) as required by application.
2. Equal by Siemens Milltronics
3. Equal by Endress + Hauser

2.03 GAUGE PRESSURE TRANSMITTERS

A. Standard specifications:

1. NEMA 4X, corrosion resistant polyurethane-covered aluminum enclosure.
2. Provided with integral 2-valve manifold for isolation, venting, draining or calibration.
3. Provided with diaphragm or flanged annular seals (by Red Valve or equal) where in contact with process fluids other than clean water or air. Diaphragms and/or seals shall be factory-installed and factory-calibrated by the supplier of the seal or pressure transmitter prior to delivery to project site.
4. 24vdc loop powered
5. Integral digital LCD display
6. Transmitter output 4-20 mA

7. Accuracy +/- 0.2% Span
8. Stability +/- 0.25% Upper Range Limit.
9. Local adjustments – zero and span
10. Overrange and overload protection
11. 316 SS diaphragm
12. Glass-filled PTFE O-Ring
13. Silicone fill fluid

B. Execution:

1. Where in contact with clear water or air:

   a. Shall be connected to process piping with flexible stainless steel impulse piping such as to limit transmission of vibration to device as directed by civil engineer unless specifically shown otherwise.
   b. Impulse piping shall be as short as possible and shall slope at least 1 in./foot upward from the transmitter toward the process connection.

2. Where in contact with other fluids:

   a. Diaphragm seals shall be installed onto process piping or vessel as per manufacturer's recommendations.
   b. Flanged annular seal shall be installed in-line within process piping as per manufacturer's recommendations.
   c. Contractor shall coordinate installation (and insertion into or connection to process piping or vessel) with associated piping or vessel prior to ordering materials.

C. Acceptable manufacturers: Rosemount 3051CG series

2.04 CHLORINE CYLINDERS WEIGHT (LEVEL) SCALES:

A. See civil plans/specifications for requirements.

2.05 CHLORINE LEAK ALARM DETECTOR

A. See civil plans/specifications for requirements.

2.06 CHLORINE GAS VACUUM ALARM DETECTOR

A. See civil plans/specifications for requirements.

2.07 CHLORINE FEED SOLENOID VALVE

A. See civil plans/specifications for requirements.

2.08 ELECTRICAL SURGE AND TRANSIENT PROTECTION

A. General

1. Function: Protect the system against damage due to electrical surges.

B. Application: As a minimum, provide surge and transient protection (with proper grounding) at all field instrumentation connected to process piping or where part of circuitry extends outside building(s), as described below:

1. Analog Instruments::

a. Provide surge protection device(s) at power and analog circuit connections to the instrument equipment.
b. At 2-wire, loop-powered instruments, surge protection device shall:

1) Be of stainless steel, pipe-mounted, IP67 construction, nipple-mounted at the instrument as directed by the device supplier.
2) Have 10kA total nominal discharge current per line (based on 8/20µs waveform).
3) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal.
4) Be Dehn DEHNpipe series or equal by MTL Technologies.

c. At 4-wire, separately-powered instruments, surge protection device(s) shall:

1) Be mounted within one (1) appropriately-sized NEMA 4X enclosure with viewing window at the field device.
2) Be of DIN-rail mountable construction.
3) Have 10kA total nominal discharge current per line (based on 8/20µs waveform) for the analog signal.
4) Have 15kA total nominal discharge current per line (based on 8/20µs waveform) for the power input.
5) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal/power circuit(s).
6) Be one of the following:

(a) Edco SLAC series
(b) Dehn Blitzductor XT series (for the analog signal) plus Dehn DEHNguard series (for the power input), combined into (1) overall NEMA 4X enclosure.

C. Installation and grounding of suppressor: As directed by manufacturer. Provide coordination and inspection of grounding.

PART 3 - EXECUTION

3.01 INTERFACE REQUIREMENTS

A. The instrumentation supplier shall forward submittals clearly identifying all instrumentation interface requirements (inputs/outputs, network connections, register locations for network connections, loop power source requirements, etc.) to the supplier

of the associated control and monitoring system, or SCADA system, prior to construction of the associated control and monitoring panels, PLC's, RIO's, RTU's, etc.

3.02 IDENTIFICATION AND LABELING:

A. Refer to Specification Section 16075 for identification and labeling requirements.

3.03 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations.

B. All mounting hardware shall be of corrosion resistant material unless noted otherwise. In exterior or typical process areas, mounting hardware shall be type 316 stainless steel. In extremely corrosive areas (Chlorine rooms, Fluoride rooms, etc.), mounting hardware shall be of non-metallic construction as recommended by the equipment supplier.

3.04 CALIBRATION

A. All instruments provided, relocated or modified within the project shall be calibrated and ranged by a factory-trained representative to the range specified by the process engineer.

B. All calibration procedures shall be implemented using equipment meeting NIST standards.

C. Calibration sheets shall be used to record all applicable calibration settings and calibration equipment data, and to indicate certification of traceability to National Institute of Standards and Technology (NIST) standards.

3.05 TESTING

A. General

1. All elements of the instrumentation system shall be tested to demonstrate that the total system satisfies all of the requirements of this specification.
2. As a minimum the testing shall include the following:

    a. Operational Readiness Test (ORT)
    b. Functional Acceptance Test (FAT)

3. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsection's producing the correct result (effect), the specific test requirement will have been satisfied.

B. Operational Readiness Test (ORT)

1. General: Prior to start-up, the entire installed instrumentation system shall be certified (inspected, tested and documented) that it is ready for operation.

C. Functional Acceptance Test (FAT)

1. The entire instrumentation system shall be tested on-site to demonstrate that it is operational and in conformance with these specifications.
2. Tests shall demonstrate specified functions, calibration and ranging to the satisfaction of the owner.

3.06 TRAINING

A. General

1. Provide an integrated training program for the owner's personnel at the jobsite. Tailor the training program to meet the specific needs of the Owner's personnel. Include training sessions, classroom and field, for managers, engineers, operators and maintenance personnel.
2. The training shall be carried out by technically competent and experienced instructors
3. The Owner shall have the right to make and reuse video tapes of all of the onsite training sessions.
4. A minimum of one eight (8) hour day shall be provided on site for training owner and or engineer selected attendees.

3.07 SPARES:

A. A quantity of spare surge protection devices for field instruments equal to 25% of the quantity specified of each type, or one of each type (whichever is greater) shall be provided. For example, a system with surge protection devices for two (2) loop-powered 2-wire field instruments and nine (9) 120V-powered 4-wire field instruments shall be provided with one (1) spare surge protection device for loop-powered 2-wire field instruments and three (3) spare surge protection devices for 120V-powered 4-wire field instruments.

3.08 SYSTEM DOCUMENTATION:

A. Upon completion of the installation, the instrumentation supplier shall provide full documentation sets (quantity as required by other specification sections) to the owner for approval. Documentation shall include:

1. A record set of all information submitted prior to installation.
2. Records of all calibration sheets described above.

3.09 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

A. Completion of the installation, in-progress and final inspections, receipt of the system documentation, and successful performance of the instrumentation system for a two week period will constitute acceptance of the system.

3.10 WARRANTY:

A. The contractor shall fully warrant the completed instrumentation system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of

final acceptance.

END OF SECTION 16905