PROJECT MANUAL
FOR

WATER TREATMENT PLANT FILTER
AND
SCADA IMPROVEMENTS, PHASE 1

FOR

THE CITY OF NORTHPORT
NORTHPORT, ALABAMA

PROJECT NO. 21014

March, 2023

KREBS

PREPARED BY

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APPENDIX B

INSTRUCTIONS TO BIDDERS

RECEIPT OF BIDS

Sealed Proposals will be received by The City of Northport, at 3500 McFarland Blvd., Northport, Alabama 35476 where bids will be received, until **2:00 pm local time on April 13, 2022** for furnishing all labor, tools, materials and equipment, and for doing the work of construction, according to the Contract Documents, as described in the Advertisement for Bids and in the Specifications, Drawings, and other Contract Documents. No bids will be received after the time set forth hereinabove; and the Proposals will be publicly opened and read aloud.

CONTRACT DOCUMENTS

Contract Documents are open to public inspection at the Northport Water Treatment Plant, 11580 Larry Lake Rd. Northport, Alabama 35475 or at the office of the Engineer, Krebs Engineering, Inc.,2100 River Haven Drive, Birmingham, Alabama 35244.

Copies (hard copies or pdf copies) of the Contract Documents can be obtained from the office of the Engineer, Krebs Engineering, Inc., 2100 River Haven Drive, Suite 100, Birmingham, Alabama 35244. A deposit of $50.00 per set of hard copies will be required for each set of Contract Documents issued. The full amount of deposit for the first set of Contract Documents will be returned to Contractors submitting bonafide Sealed Bids for construction of the project, provided all Contract Documents are returned to the Engineer in good condition within ten (10) days after the opening of the bids.

DEFINITIONS

The following terms as used in these Contract Documents, are respectively defined as follows:

(a)	"Contractor" or "Contractors":	The person, firm or corporation signing the Contract with the Owner.
(b)	"Subcontractor":	One who contracts with the Contractor to perform all or any part of the Contract to be performed by the Contractor under the attached Documents.
(c)	"Work at Site of Project":	Work to be performed, including work normally done at the location of the project. See Article II of the Contract Agreement and Section 1.1 of the General Conditions.
(d)	"Purchaser, Owner, Authority":	The City of Northport
(e)	Engineer:	Krebs Engineering, Inc. or their duly authorized representative.
(f)	"Days":	Calendar days, unless otherwise specified.
(g)	"Proposal":	Wherever "Proposal" is used, it shall mean "Bid" and must be on the required Proposal Form.

PROPOSAL FORM

The Engineer will furnish Bidders with a Proposal Form. No bid will be considered unless submitted on such form. The Bidders shall complete the Proposal Form in manner prescribed, using ink for writing figures, or figures may be typed. The Bidder must sign the Bid correctly and legibly; and shall state his interest, title, or office in the company submitting the Bid. If the Bid should be made by an individual, his full name and address shall be shown; if made by a firm or partnership, the full name and address of each member of the firm or each partner shall be shown; and if made by a corporation, the full names and addresses of the president, secretary and treasurer shall be shown. Should the Proposal Form not be fully completed in ink by the Contractor, the Bid will be deemed to be informal and may be rejected.

The Proposal Form shall be fully completed in accordance with the Instruction to Bidders, in accordance with any instructions to bidders given in the Specifications (including the General Conditions), and without any excisions, alterations, special conditions or alterations made by the Bidder. The Bidder shall be fully responsive to all instructions relating to the Proposal.

BIDS

Bids shall be enclosed in a sealed envelope, endorsed **Northport WTP – Filter and SCADA Improvements - Phase I, Contract No. 21014** and addressed to the City of Northport.

The Bidder shall show, on the outside of the envelope and on the last page of the Proposal Form, firm's Contractor's License Number for the State in which the project is located, and shall also show, on the outside of the envelope, firm's name and address.

No Bid will be received after the time specified in the Advertisement for Bids.

Any Bidder may withdraw firm's bid, either personally, by email, or written request, at any time prior to the scheduled closing time for the receipt of bids.

No Bidder may withdraw firm's bid for a period of sixty (60) days after the scheduled closing time for receipt of bids, as set forth in the Advertisement for Bids.

The Owner reserves the right to reject any or all bids, to waive any informalities in any bid, to select or reject Alternate Bid Items identified on the Proposal Form, and to accept any bid considered advantageous to the Owner.

A bid which has been sealed in its delivery envelope may be revised by writing a change in price on the outside of the envelope over the signature of the bidder or the bidder's "authorized representative". In revising the bid in this manner, the bidder must only write the amount of the change in price on the envelope and must not reveal the bid price, and must specify which item numbers on the Proposal Form are changed. An envelope change to a unit price proposal shall be specifically written in such a way as to alter one or more unit prices.

AWARD OF CONTRACT

The Contract, if awarded, will be awarded to the low, responsive, responsible bidder as soon as practicable, provided a satisfactory bid has been received. In order to be considered for the award of the Contract, the Bidder shall demonstrate to the Owner that he possesses all of the above named qualifications.

BID GUARANTY

Each Bidder must enclose with his Proposal a Bid Bond or a Cashier's Check drawn on a bank that is located in the same state as the project site, in the amount of not less than five percent (5%) of the total bid, but not more than $10,000.00. The payee of such bond or cashier's check shall be The City of Northport. The Bid Bond or Cashier's Check shall bear the same date as that set for the receipt of bids.

Bid Bonds shall be returned to all bidders, other than the low and two next low bidders, when the low bids have been determined. Those of the three low bidders will be returned after execution of the Contract.

If a bidder to whom a contract is awarded shall refuse or neglect to execute the Contract and furnish security in the amount required within ten (10) days after the notice has been given him of such award, his bid bond shall be forfeited to the Owner as liquidated damages for such refusal or neglect.

The successful bidder will be required to furnish, through an authorized agent in the state in which the project is located, a Performance Bond, Labor and Material Payment Bond, Employer's Liability and Workmen Compensation Insurance, Comprehensive Liability Insurance, Property Insurance, Comprehensive Automobile Liability, Special Hazards or Perils and shall furnish proof of carriage of all of the above insurance all as set out in detail under "General Conditions" of the Specifications. The Performance Bond and the Labor and Material Payment Bond must be countersigned by an agent whose office is located in the state in which the project is located and who is authorized to do business in that state; and a valid Power-of-Attorney shall be attached to each Bond.

INTERPRETATIONS

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the Contract Documents, he must submit a written request to the Engineer for interpretations thereof. The persons submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made by addendum duly issued, and copy of such addendum will be mailed by certified mail (with return receipt requested) or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanation or interpretation of the Contract Documents.

COMMENCEMENT AND COMPLETION OF WORK

Following the execution of the Contract by the Owner and the Contractor, the Contractor will be authorized to commence work by written Notice to Proceed from the Owner. The Contractor shall then commence work on the project within the time stated in the Contract, unless such time stated is extended by signed written agreement between the Owner and the Contractor, and shall fully complete all work under the Contract within the number of consecutive calendar days specified in the Contract.

FAMILIARITY WITH LAWS

The Bidder is assumed to have familiarized himself with all state laws and with all local ordinances and regulations which, in any manner, may affect the conduct of the work or those engaged or employed on the work, and no pleas of misunderstanding will be considered.

The attention of bidders is called to the provisions of state law governing general contractors, and bidders shall be governed by the provisions of said law insofar as it is applicable. The above mentioned provisions of the code make it illegal for the Owner to consider a bid from anyone who is not properly licensed under such code provisions. The Owner, therefore, will not consider any bid unless the bidder produces evidence that he is so licensed. Neither will the Owner enter into a Contract with a foreign corporation which is not qualified under state law to do business in the state in which the project is located.

ASSIGNMENT OF CONTRACT

The Contractor shall not assign his Contract, nor any part thereof, nor any monies due, or to become due thereunder, without prior written consent of the Owner. In case the Contractor, with the consent of the Owner assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in or to any monies due or to become due to the Contractor shall be subject to all claims, rights and remedies of the Owner, and all prior valid claims of all persons, firms, and corporation for services rendered or materials supplied for the performance of work under the Contract.

SUBCONTRACTING

No part of the Contract shall be sublet without the prior written consent of the Owner. The Contractor shall, following execution of the Contract, immediately submit to the Owner the names of subcontractors whom he/she proposes to employ on the project.

EXECUTION OF CONTRACT

The Contract Agreement/Documents shall be executed in triplicate, each counterpart of which shall be considered as an original without accounting for the absence of any of the other counterparts or copies.

QUALIFICATIONS OF BIDDERS

Bidders must meet the qualifications described in the Statement of Bidder Qualifications at the end of this section. Bidders must submit/include the Statement of Bidder Qualifications with their bid(s). Questions or clarifications regarding the Statement of Bidder Qualifications should be submitted in writing during the bid period.

The Contract award, if made, will be made to the low, responsive, responsible Bidder.

A responsive bid shall be evidenced by: (1), a Proposal Form completed in accordance with the Instructions to Bidders and with instructions and/or requests or directions contained in any other sections of the Contract Documents (including the Specifications and General Conditions); (2), a Proposal Form not evidencing any apparent unbalanced pricing for performance of the items of work; (3), a Proposal Form without excisions, alterations, special conditions or qualifications made by the Bidder; and, (4), a Proposal Form containing no alternative bids or offerings (by inclusion, attachment, or otherwise) for any items unless such alternative bids or offers are specifically requested in the Proposal Form and/or Contract Documents.

That a Bidder is responsible may be evidenced by the following facts: (1), that he maintains a permanent place of business; (2), that he has adequate financial capability for meeting the obligations contingent to the work; (3), that he has adequate forces to properly perform the work within the time limit specified; and (4), that he has a competent and experienced organization.

In order to be considered for the award the Bidder shall present to the Owner satisfactory evidence that: (1), he has the necessary capital and financial resources to undertake and complete the project; (2), he has equipment, in good working order, adequate for performance of work within the time specified; (3), he has within his organization, at the time of construction, management and supervisory personnel available for assignment to the project; (4), the construction management and supervisory personnel are skilled and experienced in the particular type of work to be undertaken on the project; and (5), meets the requirements listed above.

STATEMENT OF BIDDER'S QUALIFICATIONS

The Bidder shall be one whose principal business and experience is similar to the work included in this project. The Bidder shall have successfully completed, under his/her present firm name, not less than **three (3)** projects of similar size and scope. Similarly, the Project Manager and Superintendent to be assigned to this project must meet the following minimum requirements:

1. Minimum of **5 years** of experience (in their current/respective role) with projects of similar size and scope.
2. Minimum of **1 year** of experience with Bidder's firm and must be (currently and for past **12 months**) full time, regular employees of Bidder's firm.

Bidder must provide a Statement of Bidder Qualifications which includes clear and comprehensive responses to each item below. Statement must be signed by legal representative of the Bidder and signature must be notarized. The statement should be attached to this page. Failure to include a response to ALL items may result in bid being considered non-responsive. Bidder may submit information in addition to the items below.

1. Name/address of firm/Bidder, and date and location of organization/incorporation, and general description of work performed by your company.

2. List all projects within the past **5 years** where the following occurred:

    - Bidder failed to complete any work awarded to you.
    - Bidder defaulted on a contract.
    - Bidder was assessed Liquidated Damages.
    - Bidder failed to complete the project by the Final Completion Date but negotiated to avoid Liquidated Damages (include brief description, explanation, and project owner contact info.).

3. List and provide brief description of last 3 projects of similar size and scope and include date and contact information for project owner.

4. Provide name and brief description of experience of the Bidder's proposed Superintendent, including date and project owner contact information for current project on which he/she is assigned and for past 3 projects of similar size and scope.

5. Provide name and brief description of experience of the Bidder's proposed Project Manager, including date and project owner contact information for current project on which he/she is assigned and for past 3 projects of similar size and scope.

END OF SECTION

PROPOSAL FORM

MADE BY _____

ADDRESS _____

TO: **The City of Northport**

The undersigned, as Bidder, proposes and agrees, if this Bid is accepted, to enter into a Contract with The City of Northport in the form of Contract specified and shown in the attached Contract Documents, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation, and labor necessary to complete the construction of a **Northport WTP – Filter and SCADA Improvements - Phase I, 21014**, as described in the Advertisement for Bids, and in the Contract Documents, which are hereby referred to and made a part of the same extent as if fully set out herein, and in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents, to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the attached Instructions to Bidders, General Conditions, and other Contract Documents, based on the following pricing:

BASE BID

ITEM NO.	APPROXIMATE QUANTITIES	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL PRICE FOR ITEM
1.	Complete	Construction of Water Treatment Plant Filter and SCADA Improvements in Accordance with Contract Documents Lump Sum	Lump Sum	$
2.	Complete	Allowance for SCADA Scope of Work in Appendix A	Lump Sum	$120,000
			Total Amount of Base Bid	$

BASE BID: For construction complete as shown and specified in table above, the sum of

_____

Dollars $

ADDENDA: The Bidder acknowledges receipt of Addenda Nos. _____ , _____ , _____ , _____,_____, _____, _____ .

ALTERNATE BID

ITEM NO.	APPROXIMATE QUANTITIES	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL PRICE FOR ITEM
1.	Complete	Replace Section of Surface Wash Pipe, Filter Nos. 1 - 3 Lump Sum	Lump Sum	$

The award of the Contract will be based on the total/sum of the base bid price and the alternates (if any) selected by the Owner. The Owner will receive bids and all pricing will be read aloud, but the project will not be awarded until the bids are evaluated and a determination is made on which alternates are selected. Once the Alternates have been selected, the final bid amount will be calculated (base bid price plus adjustments for any alternate selected) for each bid submitted, and if an award is made, the project will be awarded to the responsive bidder with the lowest final bid amount.

The Bidder declares that he/she has examined the site of the work, and has familiarized himself/herself with the existing and proposed/new facilities (including the location, nature, sizes/dimensions, current and intended future use, etc.). The Bidder declares that he/she has fully informed himself/herself of conditions that would affect the proposed work, that, prior to the tender of his/her bid, he/she has examined the Contract Documents for the work and has read all special instructions and provisions contained in the Documents, and that he/she has satisfied himself/herself with respect to the quality and extent of work to be performed. The Bidder declares that the firm, the project manager and the superintendent are qualified and meet or exceed the experience requirements as outlined in the Instructions to Bidders and/or elsewhere in the Contract Documents.

The Bidder declares that he/she understands that, when quantities of work for which unit price bids are requested in the Proposal, such quantities are approximate only and are subject to either increase or decrease, that, should the quantities of any of the work items be increased, the Bidder proposes to perform the additional work at the unit prices bid by him, that, should the quantities of any of the work items be decreased, payment will be made only for the actual quantities of work performed and such payment will be based upon the unit prices bid by him/her, and that he/she shall make no claim for profits anticipated on the decrease in quantities of work. Actual quantities will be paid for as the work progresses, in accordance with the provisions of the Contract Agreement, and such quantities shall be subject to final measurements and determinations made upon completion of the work.

The Bidder understands that the Owner reserves the right, in the Owner's discretion, to reject any or all bids, to waive any informality in any bid, and to accept any bid considered to be advantageous to the Owner.

The Bidder agrees that his/her bid shall be valid for a period of sixty (60) calendar days after the date set for receipt of bids, and shall not be withdrawn for a period of sixty (60) calendar days after the date set for receipt of bids.

The Bidder has attached hereto a Bid Bond executed by a Surety Company authorized to do business in the state in which the project is located (with valid Power-of-Attorney attached), or a cashier's check drawn on a bank in the state in which the project is located, in favor of (made payable to) **City of Northport** the amount of 5% of the bid amount (total), but in no event more than $10,000.

The Bidder agrees that, should he/she be notified that his/her Bid on the work has been accepted, he/she will, within ten (10) days from receipt of such notice, execute the formal Contract Agreement bound herein, and will furnish with the Contract evidence of Insurance Coverage of his/her construction operations and all of his/her operations associated with the project, all in accordance with the requirements of the General Conditions.

The Bidder further agrees that, in case of failure on his/her part to execute said Contract Agreement, and to furnish all Bonds required by the Contract Documents, within ten (10) consecutive calendar days after receipt of notice of award of Contract to him, the monies payable to the Obligee of his/her Bid Bond, in accordance with the terms and conditions of the Bond, shall be paid to the Owner as liquidated damages for the delay and additional expense to the Owner caused by such failure on the part of the Bidder.

The Bidder hereby agrees that, should the work under the Contract be awarded to him/her, he/she will commence work under this Contract on or before a date to be specified in written "Notice to Proceed" given by the Owner, and that he/she will achieve Substantial Completion of the Contract within **90** consecutive calendar days following the Notice to Proceed, and will achieve Final Completion of the Contract within **120** consecutive calendar days following the Notice to Proceed. The Bidder agrees to pay, as liquidated damages, the sum of **$500** for each consecutive calendar day after the date set for Substantial Completion of the work until such time as Substantial Completion has been achieved. Once Substantial Completion has been achieved, the Bidder will not be assessed additional liquidated damages unless and until he/she fails to meet the Final Completion Date. If the Bidder fails to meet the Final Completion date, then he/she agrees to pay, as liquidated damages, the sum of **$500** for each consecutive calendar day after the date set for Final Completion of the work, all as provided in the General Conditions. At no time shall the Bidder pay more than **$500** per calendar day for liquidated damages. **The Bidder agrees that, once the Substantial and/or Final Completion dates have passed, the Owner/Engineer will begin deducting liquidated damages from the monthly progress payments.** The Bidder further agrees that he/she will not make any claim

for extra compensation should completion of work under the Contract be effected in advance of the time specified hereinabove.

The undersigned Bidder states that he/she fully understands the meaning of "low, responsive, responsible Bidder", as defined in these Documents, and that these criteria will be applied in the evaluation of this Bid.

The undersigned, as Bidder, hereby declares that the name (or names) of the only person (or persons) interested in this Proposal, as principal (or principals), is (or are) as herein below set out and that no person other than that (or those) herein below stated has any interest in this Proposal, or in the Contract to be entered into; that this Proposal is made without connection with any other person, firm or corporation making a proposal; and that it is in all respect fair and in good faith, without collusion or fraud.

Following are the names and addresses of all persons, firms, and corporation interested in the foregoing bid:

_____

_____

_____
(Type or Print Name and Address of Firm)

_____
(Type or Print Contractor License No.)

_____
(Type or Print Name and Title of Officer/Legal Representative of Firm Submitting Bid)

_____
(Signature of Officer/Legal Representative of Firm Submitting Bid)

_____
(Type or Print Date)

BID BOND

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

_____

_____

as Principal _____ and

as Surety, are hereby held and firmly bound unto _____

_____

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 submitted to _____ a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing, for the _____ Northport WTP – Filter and SCADA Improvements – Phase I.

_____

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.

_____ (L.S.)
Principal

_____
Surety

By _____

SEAL

CONTRACT AGREEMENT

THIS AGREEMENT is made and entered into as of the _____ day of _____ in the year of 2022, by and between _____ (the "Owner"), and _____ (the "Contractor")

WITNESSETH: That the Owner and the Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article I. **CONTRACT DOCUMENTS.** The Contract Documents shall consist of: this Agreement; the Contractor's Proposal on the required form; the General Conditions; the Performance Bond on the required form; the Labor and Material Payment Bond on the required form; all Addenda issued prior to the submittal of the Proposal; all Modifications issued, agreed upon, and signed by the Owner after the execution of this Agreement; and the Drawings (Plans) and Specifications as prepared by Krebs Engineering, Inc. (the "Engineer"), and as on file in the office of the Engineer. The documents enumerated above form the Contract and all are as fully a part of the Contract as if attached to this Agreement and fully set forth herein. The Contract Documents are sometimes collectively referenced as the "Contract," and any reference to the "Contract" in this Agreement and elsewhere in the Contract Documents includes all of the Contract Documents.

Article II. **SCOPE OF WORK.** The work to be done under this Contract by the Contractor, at his/her own cost, shall consist of furnishing all labor, materials, supplies, tools, documentation, facilities, transportation, services, testing, and equipment, and of performing all work, necessary to construct and fully complete the project entitled Northport WTP - Filter and SCADA Improvements - Phase I all in accordance with the Drawings and Specifications and with the requirements and provisions of the Contract Documents. The Contractor's scope of work under this Contract is not limited merely to physical construction and related services, material, or equipment, but also includes the totality of all of the Contractor's obligations (*e.g*., including insurance, indemnity, and warranty obligations) under or arising from any of the Contract Documents

Article III. **TIME OF COMPLETION.** The work to be performed under this Contract shall be commenced within 10 calendar days after the date on which the Notice to Proceed is issued. The work shall be Substantially Complete within **90** calendar days after the date on which the Notice to Proceed is issued, and Final Completion of the work shall be achieved within **120** days after the date on which the Notice to Proceed is issued, subject, only to such extensions of time as may be expressly authorized by provisions of the Contract Documents.

Should the work under Contract not be fully completed within the times/dates specified, it is understood and agreed that the Contractor shall be liable to the Owner for liquidated damages, (to be deducted from the monthly/periodic and final estimates of work performed by the Contractor) computed at the rate of $**500.00** per day for each additional day required to achieve Substantial Completion of the work. Once Substantial Completion has been achieved, the Contractor will not be assessed additional liquidated damages unless and until he/she fails to meet the Final Completion Date. If the Contractor fails to meet the Final Completion date, then he/she agrees to pay, as liquidated damages, the sum of **$500.00** for each consecutive calendar day after the date set for Final Completion of the work. At no time shall the Contractor pay more than **$500.00** per calendar day for liquidated damages.

It is understood and agreed that these liquidated damages are not a penalty, but are to reimburse and compensate the Owner for the damages caused by the delay in the completion of the work, and that these liquidated damages may be deducted from the amounts otherwise payable to the Contractor or alternately may be recovered directly from the Contractor or its performance bond surety. It is also understood and agreed that, in the event that the work should be completed in advance of the completion date specified, the Contractor will make no claim for extra payment therefor.

Article IV. **CONTRACT PRICE.** The Owner shall pay the Contractor in full for performance of work under this Contract, in accordance with the price or prices set forth in the Proposal submitted by the Contractor, which Proposal made a part hereof to the same extent as if fully set out herein, but subject to such additions and deductions as expressly provided for in the Contract Documents, the sum of _____ (the "Contract Price" or "Contract Amount").

The Contract Price may be adjusted only as expressly provided in the Contract Documents.

Article V. **CHANGES IN WORK AND EXTRA WORK**. The Owner shall have the right to increase or decrease quantities of work, to make changes in the work, and to require the Contractor to perform extra work necessary for the satisfactory completion of the project.

Where new and/or additional items of work are found to be necessary for the satisfactory completion of the project, and where the character of the work is such that a reasonable price for the performance of the work cannot be established by use of contract prices or combinations thereof, such new and/or additional items of work shall be classed as Extra Work.

The procedure to be followed in such cases shall be in accordance with the provisions of the Articles of the General Conditions relating to CHANGES IN WORK, and PAYMENT FOR EXTRA WORK.

Article VI. **PROGRESS PAYMENTS.** The Owner shall make progress payments to the Contractor in amounts equal to values of work performed on the project through the closing dates of the preceding estimate periods, but less five percent (5%) of the combined values and less previous payments made. The five percent (5%) retained percentage may be held by the Owner until the value of work completed in accordance with the Contract Documents (as determined by the Engineer) at the end of any estimate period equals or exceeds fifty percent (50%) of the total amount of the Contract, after which time, if the Owner and the Engineer deem that satisfactory progress is being made, no further retainage will be withheld. The retainage as set forth above shall be held until final completion and acceptance of the work. At the Owner's discretion, and when the work has reached substantial completion, as determined by the Engineer in accordance with the provisions of the Contract Documents, the retainage may be reduced to such an amount as would reasonably cover 150% of the cost of correction of items of work heretofore found to be faulty and the cost of work remaining to be done in order to effect the completion of all of the work in full accordance with the provisions of the Contract Documents. Progress payments will be made in accordance with the provisions of the General Conditions.

Article VII. **FINAL PAYMENT.** Final payment, constituting the entire balance of the Contract Price, shall be paid by the Owner to the Contractor within thirty days after the full completion and acceptance of the work and satisfaction of all conditions and requirements for final payment provided in the Contract Documents. The work will not be accepted until the

Contractor has certified that he/she has completed all of the work in full accordance with the provisions of the Contract Documents, the Owner and the Engineer have completed the final review of the work and found that it appears to have been fully completed in accordance with the provisions of the Contract Documents, the Contractor has advertised completion of the work in accordance with the General Conditions, and the Contractor has presented to the Owner satisfactory evidence that all indebtedness connected with the work has been fully paid and satisfied, all as set forth in the General Conditions.

Article VIII. **MISCELLANEOUS PROVISIONS.** Terms used in this Agreement which are defined in the General Conditions shall have the same meanings as designated in those component parts of the Contract Documents.

The Contract Documents, which constitute the entire agreement between the Owner and the Contractor are listed in Article I of this Agreement and, except for Modifications issued after the execution of this Agreement, are enumerated below. The signatures which appear hereunder shall have the same force and effect as if appearing on all of the Contract Documents enumerated as follows:

1. Contract Agreement Pages _____
2. Proposal Pages _____
3. General Conditions Pages _____
4. Supplementary Conditions Pages _____
5. Performance Bond Pages _____
6. Labor and Material Payment Bond Pages _____
7. Specifications Pages _____
   Sections _____
8. Drawings Sheets _____
9. Addenda (include date of addenda): _____
   _____
   _____
   _____

IN WITNESS HEREOF, the said Contractor has hereunder executed this Agreement by his/her signature shown hereon, and said Owner has hereunder executed this Agreement by affixing hereto his/her corporate seal and by signature of his/her corporate officer(s) as shown, on the date first written above, in 3 counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original.

By signing this Agreement, the contracting parties affirm, for the duration of the Contract, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the Contract and shall be responsible for all damages resulting therefrom.

CONTRACTOR

_____
(Print/Type Name of Firm)

_____
(Print/Type Name and Title of Officer/Legally Authorized Individual)

_____
(Signature of Officer/Legally Authorized Individual)

_____
(Print/Type Name of Attesting Witness)

_____
(Signature of Attesting Witness)

OWNER

_____
(Print/Type Name of Owner)

_____
(Print/Type Name and Title of Owner Representative)

_____
(Signature of Owner Representative)

_____
(Print/Type Name of Attesting Witness)

_____
(Signature of Attesting Witness)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that we _____

_____

_____

hereinafter called the Principal, and _____

_____

hereinafter called the Surety, do acknowledge ourselves to be held and firmly bound unto

_____

hereinafter called the Owner, in the penal sum of _____

_____

for payment of which sum well and truly to be made in lawful money of the United States, we bind ourselves, our successors, heirs, executors, administrators, assigns and personal representatives, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION OR BOND IS THIS:

Whereas, the Principal has entered into a certain written contract with the Owner, bearing the date of _____ , 20 _____ for the performance of the Northport WTP – Filter and SCADA Improvements – Phase I.

(the "Contract"), which is fully incorporated herein by reference, and made a part hereof to the same extent as if set out herein in full, and the Principal and Surety are and shall remain bound under this Bond for the full and faithful performance and satisfaction of all of the Principal's duties, undertakings, work, and obligations under the Contract,

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform and satisfy all of his duties, undertakings, work, and obligations, all in accordance with the covenants, terms, conditions, agreements and provisions of the Contract, and if the Principal shall satisfy all claims and demands made or incurred under the Contract, shall fully correct all faulty work or defective work and make good any work that does not comply with the Principal's warranty and guaranty, shall fully indemnify and save harmless the Owner from all costs and damages whatsoever which the Owner may suffer by reason of any failure on the part of the Principal to do so, and shall fully reimburse and repay the Owner for any and all outlay, damage, and expense (including all additional engineering costs, all legal costs and attorney's fees) which the Owner may incur in making good any default or by reason of any failure by the Principal to fully perform and satisfy all of the Principal's duties, undertakings, work, and obligations under the Contract, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Be it also understood that should the Principal be in default on or non-compliance with any of its obligations under the Contract, the Owner having performed the Owner's obligations thereunder, then upon written notice by the Owner to the Surety of such default or non-compliance, the Surety shall promptly:

(1) Remedy the default or non-compliance of the Principal, or

(2) Perform and satisfy all of the Principal's remaining work and obligations under the Contract in full accordance with the terms and conditions of the Contract, using for performance of such work a contractor chosen by the Surety and approved by the Owner, or

"Promptly", as used herein, shall be defined as within thirty (30) days from the date on which the Owner has notified the Surety in writing of the Principal's default on or non-compliance with the Contract.

Whichever method may be used by the Surety to remedy the Principal's default on or non-compliance with the Contract or to complete the work under the Contract and satisfy the Principal's obligations, the Surety shall also pay to the Owner all additional costs and damages incurred by the Owner by reason of the Principal's default on or non-compliance with the Contract and the subsequent completion of the work under the Contract by the Surety.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, modification, extension of time, alteration, or addition to or of the terms of the Contract or to the work to be performed thereunder shall in any wise affect the obligation of the Surety under this Bond and the Surety does hereby waive notice of any such change, modification, extension of time, alteration, or addition to or of the terms of the Contract or to the work to be performed thereunder.

PROVIDED FURTHER, that final payment by the Owner to the Principal shall not abridge the rights of the Owner hereunder.

IN WITNESS WHEREOF, this instrument is executed in ___3___ counterparts, each one of which shall, without proof of or accounting for the other counterparts, be deemed an original, on this day the _____ day of _____, 20 ____.

ATTEST:

By _____
(Principal Secretary)

_____
Witness as to Principal

_____
Address

_____
Principal

By _____

Title _____

_____

_____
Address

_____
Surety

ATTEST:

By _____
(Surety Secretary)

_____
Witness to Surety

_____

_____
Address

By _____
Attorney-in-Fact

_____

_____
Address

Countersigned

_____
Resident Agent of Surety

_____

_____
Resident Agent Address

_____
Phone No.

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that we _____

_____

_____

hereinafter called the Principal, and _____

_____

hereinafter called the Surety, do acknowledge ourselves to be held and firmly bound unto

_____

hereinafter called the Owner, in the penal sum of _____

$ _____

for payment of which sum well and truly to be made in lawful money of the United States, we bind ourselves, our successors, heirs, executors, administrators, assigns and personal representatives, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION OR BOND IS THIS:

Whereas, the Principal has entered into a certain written contract with the Owner, bearing the date of _____ , 20 _____ for the construction of the Northport WTP – Filter and SCADA Improvements – Phase I.

a copy of which contract is attached hereto, incorporated herein by reference, and made a part of to the same extent as if set out herein in full, and the Principal and Surety are bound under this Bond which shall remain in full force and effect until all claims and demands with respect to labor and materials connected with the work under the contract have been satisfied, subject however to statutory limitations and to such other conditions as hereinafter stated.

NOW, THEREFORE, if the Principal and all Subcontractors to whom any portion of the work provided for in the contract is sublet, and all assignees of said Principal and said sub-contractors, shall promptly make payment to all persons, firms, subcontractors and corporations for furnishing said Principal and said Subcontractors with labor, materials, equipment, machinery, parts, fuel, foodstuffs, supplies, or repairs on machinery or equipment used in or incorporated in the work, for performing any work in connection with the prosecution of the work under the Contract, and under any modifications or extensions thereof, for all insurance premiums in connection with the work, for all labor performed in connection with the work whether by subcontractor or otherwise, or for reasonable attorney's fees incurred by any claimant or claimants in suits under this Bond, then this obligation shall be 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 to the Specifications accompanying the same, shall in any wise affect the obligation of the Surety under this Bond, and the Surety does hereby waive notice of any such change, extension of time, or alteration or addition to the terms of the Contract or to the Specifications.

PROVIDED FURTHER, that this Bond is subject to the following limitations and conditions:

(a) Any person, firm or corporation who has furnished labor, materials, equipment, machinery, fuel, parts, foodstuffs, supplies, or repairs for machinery or equipment used or incorporated in the prosecution of the work under the Contract, or amendment or extension thereof, and who has not received due payment for furnishing such items, shall have a direct right of action in his or their name or names against the Principal and Surety on this Bond, which right of action shall be asserted in a proceeding instituted in a Court of competent jurisdiction in the area in which the work under the contract has been performed. Such right of action shall be asserted in a proceeding brought in the name of the claimant for his or their use and benefit against said Principal or Surety, or either of them not later than one year after the final settlement of the contract, in which action such claim or claims shall be adjudicated and judgement thereon.

(b) In addition to any other legal mode of service, service of summons and other process in suits brought on this Bond may be had on the Principal or Surety by leaving a copy of the summons and complaint, or other pleading or process, with the

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and the principal and the Surety agree to be bound by such mode of service above described, and consent that such service shall be the same as personal service on the Principal or Surety.

(c) The Surety shall not be liable hereunder for any damage or compensation recoverable under any workmen's compensation or employer's liability statute.

(d) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after final settlement of the said Contract.

(e) No final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in ___3___ counterparts, each one of which shall, without proof of or accounting for the other counterparts, be deemed an original, on this day the _____ day of _____, 20 ____.

ATTEST:
By _____
(Principal Secretary)

_____
Witness as to Principal

_____
Address

_____
Principal

By _____

Title _____

_____

_____
Address

_____
Surety

ATTEST:
By _____
(Surety Secretary)

_____
Witness to Surety

_____

_____
Address

By _____
Attorney-in-Fact

_____

_____
Address

Countersigned

_____
Resident Agent of Surety

_____

_____
Resident Agent Address

_____
Phone No.

GENERAL CONDITIONS

1. WORK TO BE PERFORMED

1.1 The work to be performed under this Contract includes, without limitation, the furnishing of all materials, labor, tools, appliances, equipment, supplies, transportation, testing, inspections, documentation, facilities, and services necessary for the satisfactory completion, functioning as intended, and acceptance of all repairs, remediation, replacements, installations, improvements, and modifications described or required by any of the Contract Documents. The term "work" as used in these General Conditions and elsewhere in the Contract Documents, whether capitalized or not, is not limited merely to physical construction and related services, materials, or equipment, but also includes the totality of all of the Contractor's obligations (*e.g.*, including insurance, indemnity, and warranty obligations) under or arising from any of the Contract Documents.

1.2 The Contractor shall pay all sales, consumer, use and similar taxes for the work to be performed by the Contractor which are legally enacted when bids are received or negotiations concluded. The Contractor shall be solely responsible for determining whether the Owner is exempt from payment of sales and compensating use taxes (state and city/county) thereof on materials to be incorporated into the Work. If exempt, then the Owner will furnish the required certificates of tax exemption to the Contractor for use in the purchase of materials and equipment to be incorporated into the work. The Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by the Contractor, or to materials and equipment not incorporated into the work. Except for materials covered by the Owner's tax exemption, the Contractor shall pay all sales, consumer, use, and similar taxes for the work.

2. CONTRACT DOCUMENTS

2.1 The Contract Documents form the Contract between the Owner and the Contractor. These documents supersede prior negotiations or agreements, either written or oral, and shall not be interpreted to create a contractual relationship between the Engineer and the Contractor, or between any persons or entities other than the Owner and the Contractor. The Contract Documents are the following:

A. The Contractor's Proposal submitted on the required Proposal Form.

B. The signed Contract Agreement between the Owner and the Contractor, and all documents it incorporates by reference. Execution of the Contract Agreement by the Contractor represents that the Contractor has visited and thoroughly investigated the site to become familiar with all conditions affecting the Contractor's performance of the work.

C. These General Conditions, which outline certain responsibilities and liabilities of the Owner and the Contractor and also the authority and responsibilities of the Engineer.

D. The Drawings (Plans) and Specifications, which show and describe the work to be performed. It is the intent of the Drawings and Specifications that the Contractor shall furnish all materials, labor, tools, appliances, equipment, supplies, transportation, testing, inspections, documentation, facilities, and services

necessary for the proper execution of the work so shown or described so that it will satisfactorily fulfill all of its intended purposes and functions. The Contractor shall execute all work so described in full conformance with the Drawings, Specifications, and all other Contract Documents; shall perform all incidental work necessary to complete the project in an acceptable manner; and shall fully, timely, and satisfactorily perform all obligations provided in any of the Contract Documents.

The Engineer shall be deemed the author of the Drawings and Specifications, including those in electronic format, and shall retain all reserved rights, including the copyright. The Contract Documents are for use solely with respect to this project, and shall not be used by the Contractor for any other purpose.

The Contract Documents shall be considered to be inseparable documents, and the Contractor shall use them in performing the work in accordance with their combined intent. Before submitting its Proposal, the Contractor shall thoroughly examine and compare all of the Contract Documents, and shall specifically notify the Engineer in writing of any perceived or suspected ambiguities, deficiencies, conflicts, or omissions within the Contract Documents. The Contractor waives any right or claim to any additional compensation or any time extension on account of any such ambiguity, conflict, deficiency, inconsistency, or omission if the Contractor fails to notify the Engineer of the same specifically and in writing before submitting the Contractor’s Proposal.

The Drawings and Specifications are intended to be complementary, and where work is called for in one but not in the other, it shall be performed as though it were specified or shown in both. Any seeming conflict between the Drawings, Specifications, and other Contract Documents, shall be submitted in writing to the Engineer as provided in the Contract Documents, and the Engineer's decision shall be final.

All actual or suspected discrepancies found between the Contract Documents and site conditions, and all actual or suspected inconsistencies or ambiguities within the Contract Documents, shall be immediately (and no later than three days after the discrepancy, inconsistency, or ambiguity is first discovered or suspected) reported in writing by the Contractor to the Engineer, who shall promptly respond in writing. After such discrepancies, inconsistencies, ambiguities are first discovered or suspected by the Contractor, any work done by the Contractor on any part of the project affected by such discrepancies, inconsistencies or ambiguities before receipt of written directions from the Engineer shall be at the Contractor's risk.

The figured dimensions and/or elevations shown on the Drawings shall be used by the Contractor for the layout of the work. Where the work of the Contractor is affected by finish dimensions, such dimensions shall be determined by the Contractor at the site of the work, and he shall assume the responsibility therefor.

The Owner reserves the right to amend or revise the Drawings or Specifications, and to furnish such other detail drawings as, in the opinion of the Engineer, may be necessary for the proper prosecution of the work. All such additional drawings or specifications shall have equal force and effect as the original Drawings and Specifications.

Except as provided for otherwise, or specified to the contrary, all copies of Contract Documents required for and necessary for the execution of the work will be furnished to the Contractor without charge.

E. Addenda to Contract Documents issued during the time of bidding (before receipt of bids) or forming a part of the Contract Documents issued to the Contractor for the preparation of the Proposal, shall be covered in the Proposal, and shall be a part of the Contract Documents. Receipt of each Addendum shall be acknowledged in the Proposal.

F. Performance and Payment Bonds furnished by the Contractor at the time of execution of the Contract Agreement, which shall be in the form prescribed by the Owner, and shall be with a surety authorized to do business in the state in which the project is located and countersigned by a resident agent of the surety in that state. Bonds shall be as follows:

1. Performance Bond in an amount equal to 100% of the Contract Amount as a guaranty of performance and satisfaction of all of the Contractor's obligations in accordance with the terms of the Contract Documents.

2. Labor and Material Payment Bond in an amount equal to 100% of the Contract Amount as a guaranty on the part of the Contractor to make all payments for labor, material, supplies, and equipment in connection with the Contract and the work.

G. Written modifications signed and issued after execution of the Contract Agreement, including, but not limited to, written amendments to the Contract, Change Orders, Construction Change Directives, and minor changes in the work issued by the Engineer.

3. INSURANCE

3.1 The Contractor shall not commence any work on the project until he obtains, at his/her own expense, all required insurance; and the Contractor shall not, at any time, conduct any operations on the project or associated with the project unless such operations are covered by the specified insurance. Such insurance must have the approval of the Owner as to limit, form, and scope of coverage. The Contractor shall not permit any subcontractor to commence work on the project until the same insurance requirements have been complied with by such subcontractor (or sub-subcontractors). The insurance coverage shall be maintained throughout the full period of the Contractor's performance of its obligations, including all times after final payment when the Contractor may be correcting, removing, or replacing faulty or defective work as a warranty or correction obligation, or otherwise, or returning to the site to conduct other tasks arising from the Contract Documents, and in addition, products and competed operations coverage shall be maintained for not less than five years after final payment. At the request of the Owner, the Contractor shall be required to submit insurance certificates after project completion showing that all insurance required to be maintained after project completion remains in place. The Contractor may use only insurers with a minimum A.M. Best rating of A-VII or better. All insurance policies shall include a waiver of subrogation in favor of the Owner and the Engineer.

3.2 As evidence of specified insurance coverage the Owner may, in lieu of receipt of actual policies, and at the Owner's sole option, accept certificates issued by the insurance carrier

showing such policies to be in force for the specified period, but the Owner may thereafter at any time require that the Contractor provide complete copies of the actual policies.

3.3 Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from his/her operations or performance under this Contract. The Contractor shall have responsibility to enforce subcontractor compliance with these insurance requirements.

3.4 The types of insurance that the Contractor shall be required to obtain and maintain are listed below:

A. Workmen's Compensation and Employer's Liability Insurance shall be in strict accordance with the requirements of the current and applicable Workmen's Compensation Laws of the state in which the project is located. The insurance shall cover all of the Contractor's employees employed or associated with the project; and where any part of the work is subcontracted, the Contractor shall require the subcontractor to provide similar Workmen's Compensation and Employer's Liability Insurance for all employees of the subcontractor unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this Contract is not protected under the Workmen's Compensation Statute, the Contractor shall provide, and shall cause such subcontractor to provide, adequate coverage for the protection of all employees on the project not otherwise protected under applicable provisions of the statutes relating to Workmen's Compensation and Employer's Liability Insurance.

B. Comprehensive General Liability Insurance shall cover the Contractor and any subcontractors performing work under this Contract for any claims for bodily injury, for sickness or disease, for death, for personal injury, and for property damages which may arise either directly or indirectly out of, or in connection with, the performance of work under this Contract. The minimum limits of coverage shall be as follows:

Umbrella Liability $5,000,000 each occurrence, $5,000,000 aggregate
Bodily Injury $1,000,000 each occurrence, $2,000,000 aggregate
Property Damage $1,000,000 each occurrence, $2,000,000 aggregate
Personal Injury $250,000 each occurrence, $250,000 aggregate

The naming of minimum limits of coverage shall not be construed as limiting the Contractor's responsibility to provide contractual coverage sufficiently broad to ensure the provisions of the Article of these General Conditions relating to Indemnity, or limiting the responsibilities of the Contractor as outlined under the aforesaid Article.

Without limiting any of the above, the liability insurance coverage of the Contractor and its subcontractors shall include the following coverages and endorsements:

1. Products and completed operations coverage shall be maintained for five years after final payment. The Contractor shall furnish the Owner and each other Additional Insured evidence of continuation of such insurance at final payment and five years thereafter.

2. Blanket contractual liability coverage, to the fullest extent permitted by law, including, but not limited to, coverage of the Contractor’s contractual

indemnity obligations in Article 4 and elsewhere in the Contract Documents.

3. Broad form property damage coverage.
4. Severability of interest.
5. Underground, explosion, and collapse coverage.
6. Personal injury coverage.
7. Additional Insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

C. Comprehensive Automobile Liability Insurance shall protect the Contractor and any subcontractor performing work under this Contract from any claims for bodily injury, for death, and for property damages which may arise either directly or indirectly out of, or in connection with, the performance of work under this Contract. The minimum limits of coverage shall be as follows:

Bodily Injury - $1,000,000 each occurrence, $1,000,000 aggregate
Property Damage - $1,000,000 each occurrence, $1,000,000 aggregate

The naming of minimum limits of coverage shall not be construed as limiting the Contractor's responsibility to provide contractual coverage sufficiently broad to ensure the provisions of the Article of these General Conditions relating to Indemnity, or limiting the responsibilities of the Contractor as outlined under the aforesaid Article.

D. Property Insurance shall afford protection against physical damage to property during performance of any of the Contractor’s obligations. Insurable portions of the project shall be covered on a completed value basis; and at any given time the dollar coverage provided shall be actual value of completed work, value of work in progress, and value of stored materials. The policy by its own terms or by endorsement shall specifically permit partial or beneficial occupancy or use prior to completion or acceptance of the entire work. This insurance shall include Builder's Risk "all risk" insurance, which shall include the Owner and the Contractor as named insureds, and all subcontractors as insureds or named insureds. Such insurance shall be written on a builder’s risk “all risk” policy form that shall at least include insurance for physical loss or damage to the work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of laws and regulations; and water damage, If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder’s risk policies, by endorsement or otherwise, then such insurance may be provided through other insurance policies acceptable to the Owner

E. Special Hazards or Perils. The Contractor's Liability and Property Damage Insurance Coverage shall provide adequate protection against any death, any bodily injury or any property damage resulting from the blasting operations in connection with the Contractor's work, or in connection with the work of his/her subcontractors.

Insurance carried by the Contractor on the insurable portions of the work shall not relieve the Contractor of the responsibility for the protection of all materials, equipment, work, and other property in the vicinity of the work until the project has been accepted by the Owner, and shall not limit the Contractor's liability for failure to do so. Any loss suffered on the project by reason of the perils named under Article 3.D. or under this sub-part of Article 3 shall be borne by the Contractor and the Insurance Company providing the coverage for the Contractor, and the Owner shall not be liable for any cost of replacement of lost or damaged work or material.

F. Contractor's Pollution Liability Insurance: The Contractor shall purchase and maintain a $1,000,000 policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from the Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final payment.

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

H. Umbrella or Excess Liability Insurance: The Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability (including products completed operations), and automobile liability insurance described in the paragraphs above. Such coverage afforded shall follow form as to each and every one of the underlying policies. The coverage requirements for specific policies of insurance identified above must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

I. Notice of Cancellation or Change in Coverage. All policies of insurance required by this article shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice has been given to the Contractor and each Additional Insured. Within three days of receipt of any such written notice, the Contractor shall provide a copy of the notice to the Owner, the Engineer, and each other insured under the policy.

J. Protection of the Owner and the Engineer. The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as Additional Insureds the Owner and Engineer, and include coverage for their respective officers, directors, members, partners, employees, agents, consultants, and subcontractors; and the insurance afforded to these Additional Insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Coverage for Additional Insureds shall not be limited to claims, suits, damages, or liabilities caused be the sole negligence of the Contractor and shall include coverage for all claims, suits, damages, and liabilities that result in whole or in part from any act or omission of the Contractor,

any of the Contractor's subcontractors or suppliers, or any other person or entities for whose acts or omissions any of them is or may be responsible. The Contractor shall obtain all necessary endorsements to support these requirements.

In the event that the Contractor or his/her Surety is prevented by law or by charter from naming the Owner and his/her agents, and the Engineer, as insureds in the policies providing the coverages listed under this Article, the Contractor shall purchase and maintain during the life of this agreement Owner's & Contractor's Protective Liability Insurance in amount of not less than $1,000,000.00; and the Additional Insureds shall be the Owner, the Engineer, and their respective agents and employees. The insurance shall protect the Owner, the Engineer, and their respective agents and employees from any claim or loss arising in whole or in part from any act of the Contractor or his/her subcontractors, or any failure to act on the part of the Contractor or his/her subcontractors, during the performance of work under this Contract.

4. INDEMNIFICATION

4.1 To the fullest extent permitted by law, and in addition to any other obligations of the Contractor under the Contract Documents or otherwise, the Contractor shall defend, indemnify, and hold harmless the Owner and the Engineer, and their respective officers, directors, members, partners, employees, and agents (collectively, the "Indemnitees") from and against all claims, suits, demands, liabilities, judgments, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) (collectively, "Indemnified Losses") arising out of or relating to the performance of the work, including any work performed or undertaken by any subcontractor, any supplier or any individual or entity directly or indirectly employed by any of them to perform any of the work or anyone for whose acts any of them may be responsible. The Contractor's obligations to defend, indemnify, and hold harmless the Indemnitees shall not be excused solely because the negligence or other breach of a legal duty by an Indemnitee also caused or contributed to the Indemnified Loss, but the Contractor's indemnification obligation to an Indemnitee may be proportionately reduced to the proportionate extent that the Indemnified Loss is adjudicated to have been caused solely by the independent negligent acts or omissions of such Indemnitee.

5. PATENTS AND ROYALTIES

5.1 The Contractor shall pay the costs of all royalties, license fees and patent fees involved by use, or manner of use in the work, of all designs, devices, materials, equipment or processes, and the Contractor shall provide for such use or manner of use by legal agreement with the owner of the patent or a duly authorized licensee of such owner. All such costs referred to hereinabove shall be included in the price bid for the work under this Contract.

5.2 The Contractor shall save harmless the Owner and the Engineer from any and all loss or expense by reason of use, or manner of use, in the work of any design, device, material, equipment or process covered by letter of patent or copyright; and the Contractor shall defend all suits resulting from claims for royalties, license fees or patent fees on designs, devices, materials, equipment or processes purchased by the Contractor for use in the work, and from claims for royalties, license fees or patent fees involved by use, or manner of use, of such items by the Owner.

6. LICENSES AND PERMITS

6.1 All licenses, fees, inspections and permits necessary for the prosecution of the work shall be secured and paid for by the Contractor at no expense to the Owner other than as reflected in the price bid for the work.

7. COMPLIANCE WITH LAWS, ORDINANCES AND REGULATIONS

7.1 The Contractor shall comply with all Federal, State, and Local laws, ordinances and regulations which in any manner affect the work or the conduct of the work, and shall comply with all orders and decrees as may have been adopted or as may be enacted by bodies or tribunals having any legal jurisdiction or authority over the work. The Contractor shall maintain all documentation, file all reports, and give all notices as required for compliance with the above. The Contractor shall defend, indemnify and save harmless the Owner and the Engineer against any suits or actions of any kind or nature brought, or which may be brought, against them for any claim or liability arising from or based upon the violation of any such laws, ordinances, work regulations, safety and health regulations, orders or decrees by the Contractor, his/her subcontractors, his/her suppliers, his/her agents, his/her representatives, his/her employees, or employees of his/her subcontractors or suppliers.

7.2 By signing this Contract, the contracting parties affirm, for the duration of the Contract, that they will not violate federal immigration law or knowingly employ, hire for employment or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

7.3 Prior to starting work and in accordance with the Code of Alabama 39-2-14, a nonresident Contractor is required to register and deposit 5 percent of the Contract Amount with the Alabama Department of Revenue or provide a surety bond approved by the Commissioner of Revenue as provided in Code of Alabama 39-2-14. Within 30 days after registration, a nonresident Contractor shall file statement with Department of Revenue itemizing machinery, materials, supplies, and equipment that will be on hand at time work begins where such tangible property has been brought, shipped, or transported from outside the State of Alabama and upon which neither use taxes or ad valorem taxes have been paid and shall pay tax due at time of filing and thereafter shall report and pay tax as required by Commissioner of Revenue.

8. SAFETY

8.1 The Contractor, in the prosecution of his/her work under the Contract, is bound by the requirements of "Safety and Health Regulations for Construction" of the Occupational Safety and Health Administration, U.S. Government Department of Labor, and of other authorities having jurisdiction in safety matters.

8.2 Under the terms and conditions of this Contract, the Engineer shall not act as Safety Supervisor for the Contractor, since such responsibility remains solely with the Contractor. The Engineer shall not be responsible for establishing safety practices or for prescribing safety measures for the Contractor.

8.3 The Contractor is solely and completely responsible for conditions of the work site, including safety of all persons and property affected directly or indirectly by his/her operations during the performance of the work; and this requirement is not limited in application to normal working hours, but applies continuously twenty-four (24) hours per

day until final payment, and thereafter at any time the Contractor (or any of his/her subcontractors or suppliers) are present at the site of the work to perform continuing obligations of the Contractor.

8.4 The Engineer's duty to the Owner to review the work in order to determine its acceptability in accordance with the Contract Documents and to conduct construction review of the Contractor's performance for the benefit of the Owner, shall not be construed as a duty to review the adequacy of the Contractor's safety measures on or near the construction site and/or to direct the actions of the Contractor's employees in the performance of the work as such duties are not included among the responsibilities of the Engineer.

9. WARNING SIGNS AND BARRICADES

9.1 The provision by the Contractor of warning signs, warning lights, barricades and watchmen is subject to the requirements of "Safety and Health Regulations for Construction" of the Occupational Safety and Health Administration, U.S. Government Department of Labor, of the State "Manual on Uniform Traffic Control Devices for Streets and Highways," and of other authorities having jurisdiction in the areas of safety and traffic control. The Contractor is solely responsible for satisfying the safety and traffic control requirements of authorities concerned with or affected by this work.

10. PUBLIC CONVENIENCE

10.1 The Contractor is required to conduct his/her work as to ensure the least possible obstruction to traffic, to ensure the least possible inconvenience to the Owner and the general public and the residents in the vicinity of the work, and to ensure the protection of persons and property. Permission of the proper authority is required before any road or street is closed to the public. The maintenance of accessibility of fire-fighting equipment to fire hydrants and to such areas as are necessary for the provision of fire protection is a requirement of the Fire Department of the authority having jurisdiction. The provision of temporary measures as required to ensure the safe use of sidewalks and streets by the public is the responsibility of the Contractor. The proper functioning of all gutters, sewer inlets, drainage ditches and irrigation ditches is to be ensured by constant clean-up along with the work and by provision of temporary facilities where required for the maintenance of natural surface drainage. The implementation of all such maintenance measures and safety precautions is the sole responsibility of the Contractor.

11. SANITARY PROVISIONS

11.1 The Contractor is responsible for the maintenance of proper sanitary conditions in the area of his/her work. The provision and maintenance of such sanitary accommodations as may be required for the use of his/her employees and of his/her subcontractor's employees is subject to the Rules and Regulations of the State Board of Health and to all local Codes and Ordinances. Refer to Article 7.

12. EXISTING CONSTRUCTION AND FACILITIES

12.1 Where work under this Contract is adjacent to or crosses highways, railroads, streets, roads, access facilities, or utilities under the jurisdiction of State, County, City or other public agency, public utility or private entity, the Contractor is required to secure written permission from the proper authority and to furnish such bond (cash or surety as required), or insurance agreement as may be required before executing such construction work. A copy of the written permission and bond or insurance agreement (when required) must be filed with the Owner before any work is done. The Contractor is responsible for the

replacement and repair of all existing construction, utilities, equipment, and facilities of the Owner or others that are damaged in the execution of work under this Contract. The Contractor will be required to furnish releases from all authorities affected by the work before final acceptance of the work under this Contract.

12.2 The type, size and physical location of existing facilities are shown from available records and the accuracy of said information is not guaranteed. The Contractor shall make additional investigations as needed to verify type, size and physical location. These investigations shall include, but are not limited to, site visits, pot-holing/location, exploratory drilling/geotechnical work, discussions with Owner personnel, and review of site records/record drawings. These investigations shall occur prior to bidding the work, and prior to development of submittals/ordering equipment and materials, and prior to beginning work. The Contractor shall assume all risks arising from, or out of, performing work in the vicinity of existing facilities, or connection to existing facilities.

13. COMMENCEMENT, PROSECUTION, AND COMPLETION OF THE WORK

13.1 Following the execution of the Contract by the Owner and the Contractor, a written Notice to Proceed will be given to the Contractor by the Owner. The Contractor shall commence work on the project in good faith within the number of days specified in the Contract Agreement; and the Contractor, in accordance with the terms and provisions of the Contract Agreement, will be required to prosecute the work in such a manner and with such forces as will enable him/her to secure the satisfactory completion of the work within the time period stated in the Contract Agreement.

13.2 The time allowed for commencement of the work shall be the number of consecutive calendar days specified in the Proposal and in the Contract Agreement; and the number of days shall be reckoned from the date of the Notice to Proceed. The time allowed for the completion of the work shall be the number of consecutive calendar days as specified in the Contract Agreement; and the number of days shall be reckoned from the date specified in the Notice to Proceed for commencement of work.

13.3 Should the work under this Contract not be completed within the time specified, it is understood and agreed that the Contractor shall be liable for liquidated damages computed at the rate per day as shown in the Contract Agreement, beginning from the stated date of completion and extending to the date of final acceptance of the work. Such liquidated damages may be deducted from the Contractor's monthly or final estimates, or may be recovered directly from the Contractor and its performance bond surety. It is understood and agreed that the liquidated damages are not a penalty, but are instead money due to compensate and reimburse the Owner for the extra costs and expenses and other losses caused by the delay in the completion of the work. It is also understood and agreed that, in the event that the work should be completed in advance of the scheduled date of completion, the Contractor will make no claim for extra payment therefor. The remedies provided above do not limit, and are without prejudice to, the Owner's rights to declare the Contractor in default for failure to make satisfactory progress and to make demand upon the Contractor's surety under the performance bond.

13.4 The Owner may grant an extension of time for completion of the work when prosecution of the work is unavoidably delayed or halted by occurrences that are entirely beyond the control of Contractor or its subcontractors or suppliers, including unjustified actions by the Owner, fire, or other catastrophes, but the Contractor shall not be entitled to any extension of time unless the Contractor shall, within seven days after the first occurrence of any of the conditions resulting in the delay, give written notice to the Engineer of the cause of the delay and its probable effect on progress of the entire work.

13.5 Abnormally adverse weather conditions that are more severe than could have been anticipated for the locality of the work during any given month may entitle the Contractor to an extension of the time for completion, but only if:

(1) the abnormal weather conditions had an unavoidable adverse effect on work scheduled to be performed when the adverse weather occurred, and which in reasonable and scheduled sequence would necessarily delay completion of the entire work, and

(2) the Contractor shall, within ten days after the end of the month in which the delay occurs, give the Engineer specific written notice of the delay caused by abnormal adverse weather that occurred during that month and its effect on progress and completion of the Work, and

(3) Promptly (but not more than fourteen days) after giving notice of the delay, the Contractor provides the Engineer with sufficient data and documentation to establish that the weather conditions experienced were unusually severe for the locality of the work during the month in question and that such unusually severe weather directly impacted the work such that completion of the entire work is unavoidably delayed. Unless otherwise provided in the Contract Documents, data documenting unusually severe weather conditions shall compare actual weather conditions to the average weather conditions for the month in question during the previous five years as recorded by the National Oceanic and Atmospheric Administration (NOAA) or similar record-keeping entities.

13.6 Adjustments, if any, of the time for completion pursuant to this Article shall be incorporated into the Contract by a Contract Change Order prepared by the Engineer and signed by the Contractor, Owner, and Engineer or, at closeout of the Contract, by mutual written agreement between the Contractor and Owner. The adjustment of the time for completion shall not exceed the extent to which the delay necessarily and unavoidably extends the time required to complete the entire work of the Contract.

13.7 The Owner shall not suffer any loss or expense as a result of such occurrences or delays, except when caused solely by unjustifiable affirmative actions by the Owner, and the Contractor shall not be allowed any damages or claims for extra compensation resulting from such occurrences or delays, except to any extent proved to have been actually caused solely by unjustified affirmative actions on the part of the Owner.

14. CONSTRUCTION SCHEDULE

14.1 The Contractor shall submit to the Engineer, prior to initiating the work but not later than thirty days after the execution of the Contract, a schedule of construction operations so planned as to ensure completion of the work within the time limit specified in the Contract Agreement. The maintenance of such schedule in order to fulfill the terms of the Contract Agreement is the responsibility of the Contractor, and he shall employ such reasonable and proper measures, subject to other conditions of these Contract Documents, as he deems to be required to expedite the work and to ensure that it will be fully and satisfactorily completed within the stated time limit. If the Contractor's progress falls materially behind the currently approved construction schedule and, in the opinion of the Engineer or Owner, the Contractor is not taking sufficient steps to regain schedule, the Engineer may, with the Owner's concurrence, issue the Contractor a Notice to Cure. In such a Notice to Cure the Engineer may require the Contractor to submit a revised construction schedule to demonstrate the manner in which schedule will be regained. The

Contractor shall not be allowed additional compensation for employment of such measures.

14.2 The Contractor will be required to show in the schedule the proposed dates of commencement and completion of the various subdivisions of the work, and also to show in the schedule the estimated amount of each monthly payment (periodic estimate) that will become due to the Contractor as he maintains the progress schedule prepared by him. The preparation and submittal of the progress and payment schedule to the Owner is of benefit both to the Contractor and the Owner in that it will enable the Owner to anticipate the periodic financial needs of the project and facilitate the making of timely payments for the work. Submission of a schedule showing a completion date beyond the contract completion date should not be interpreted as approval of a contract extension by the Owner.

14.3 The Contractor shall prepare and keep current a schedule of submittals coordinated with the Contractor's schedule of construction operations. The submittal schedule is subject to approval by the Owner and shall allow the Owner/Engineer reasonable time the review submittals.

15. SUPERVISION OF THE WORK

15.1 The Contractor shall be solely responsible for planning, scheduling, organization and prosecution of the work in accordance with the Contract Documents. Observations, construction reviews, tests, recommendations or comments made by the Engineer, or by persons other than the Contractor, shall in no way relieve the Contractor of his/her obligation to timely complete all work in accordance with the Contract Documents. All work shall be done under the direct supervision of the Contractor. The Contractor shall be solely responsible for construction means, methods, techniques, sequences and procedures. The Contractor is solely responsible for safe access to the work, safe use of the work, safe working conditions, and safe occupancy of the work by and/or for all authorized persons.

15.2 The Contractor shall maintain on the project (full time) a qualified superintendent who is acceptable to the Engineer and the Owner, and who is capable of providing the efficient supervision required for the successful, timely, and satisfactory completion of the work. The superintendent shall have full authority to act in behalf of the Contractor, and all communication with the superintendent shall be considered a communication with the Contractor. The Contractor's superintendent is responsible for coordinating the work of all subcontractors, and his/her presence at the site of the work is necessary for the adequate performance of his/her supervisory duties and for the coordination of the work of all subcontractors.

15.3 The responsibilities of the Contractor relating to supervision of the work as outlined hereinabove, and the duties of the Contractor as outlined hereinabove, are all a part of the General Conditions of this Contract as referred to in the Contract Agreement.

16. SUBCONTRACTORS

16.1 The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by subcontractors. No part of the work, however, shall be sublet by the Contractor without the prior written consent of the Owner. Following the execution of the Contract, the Contractor shall submit in writing for review by the Engineer and the Owner the names of subcontractors to whom he proposes to subcontract portions of the work. The Engineer shall promptly reply to the

Contractor in writing stating whether or not the Owner or the Engineer has reasonable objection to any proposed subcontractor. If the Owner or the Engineer has reasonable objection to a listed subcontractor, then the Contractor shall propose another which is acceptable to the Owner and the Engineer, without an increase in the Contract amount. The early selection of subcontractors, in the case where the Contractor proposes to subcontract any part of the work, is essential to the proper organization of the work, and the Contractor shall therefore submit any names of proposed subcontractors upon or before request by the Owner or Engineer.

16.2 The names of proposed subcontractors so submitted shall not be changed by the Contractor after submittal of the list to the Engineer and Owner unless the consent of the Owner is first obtained.

16.3 The Contractor shall be responsible to the Owner for the acts, deficiencies, and omissions of his/her subcontractors, suppliers, and vendors (of every tier), and those of their direct and indirect employees, to the same extent as he is responsible for the acts, deficiencies, and omissions of his/her own and those of his/her employees.

16.4 The Contractor shall bind all subcontractors to the terms of the General Conditions and other Contract Documents insofar as they are applicable to the work under subcontract, and shall insert in all agreements with subcontractors appropriate provisions such as to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents. The Contractor is required to submit evidence of compliance with such conditions to the Owner before commencement of work by the particular subcontractors.

16.5 Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any subcontractor and the Owner.

16.6 For convenience of reference, to facilitate organization of the work, and for convenience in evaluating work in progress, the Specifications have been separated into titled Sections. Such separation shall not, however, operate to make the Owner or the Engineer an arbiter to establish limits of work in the contracts between the Contractor and subcontractors. The general charge to the Contractor is that all work be fully completed in accordance with the Contract Documents, and that the Contractor adhere to the terms and provisions of the Contract Agreement, of which these Conditions are a part.

17. CONTRACTOR'S RESPONSIBILITIES WITH RESPECT TO WORK BY OTHERS

17.1 The Owner reserves the right to perform construction or operations related to the project with his/her own forces, and to place portions of the work on the project under separate contracts. The Owner and the Contractor shall be mutually responsible for coordination of the activities of the Owner’s own forces or separate contractors with the work of the Contractor. The Contractor shall cooperate with other contractors with regard to use of the site, storage or materials, and execution of their work.

17.2 It is the Contractor's responsibility to inspect thoroughly all work performed by other contractors which may in any manner affect his/her work, and to notify the Engineer and the Owner in writing of the existence of any irregularities or discrepancies which will not permit him/her to complete his/her work in a satisfactory manner. Such written notice shall be provided within seven days after the Contractor first observes or suspects any irregularity or discrepancy. The failure of the Contractor to notify the Owner of the existence of such irregularities or discrepancies shall indicate that the work of other contractors has been satisfactorily completed and is in condition to receive his/her work.

17.3 The Contractor is required to keep himself/herself informed of the progress and performance of other contractors; and, where the lack of progress or poor performance (defective workmanship) on the part of other contractors will affect the Contractor in the performance and completion of his/her work, he shall immediately notify the Engineer and Owner in writing of the existence of such conditions. Failure of the Contractor to keep himself/herself informed of the status and condition of work being performed by other contractors on the project, where the status or condition of such work may affect the performance of his/her work, and failure of the Contractor to notify the Owner of status or conditions unfavorable to the proper coordination, performance, and completion of his/her work shall be construed to be acceptance by the Contractor that the status and condition of work being performed by other contractors is satisfactory for the proper coordination, performance, and completion of his/her work.

18. SATURDAY, SUNDAY, HOLIDAY, NIGHT AND OVERTIME WORK

18.1 Work on Saturdays, Sundays and Holidays, or at night, will be permitted only when the Contractor has received the written permission of the Owner. Work at such times may be required when special connections to existing systems are to be made, when new facilities are to be placed in service, when existing facilities are to be taken out of service, when it is more advantageous to the utilities involved, or when an emergency arises in the work schedule. In such cases the permission of the Owner must be secured prior to beginning work at such times, the work scheduled well in advance, and arrangements made for prosecution of the work with all safety and minimum inconvenience to the Owner and the public. All work necessary to be performed on Saturdays, Sundays and Holidays, or at night shall be so performed without additional expense to the Owner.

Except as described above (e.g. as required for special connections, emergencies, and/or operational constraints), the time and expense associated with the Owner's on-site field representative, and other costs resulting from Saturday/Sunday/Holiday/Night work shall be deducted from the Contractor's monthly pay application(s).

18.2 Holidays for the purposes of this project shall be defined as those holidays normally observed by the Owner.

18.3 It is understood that the Contractor's proposed construction schedule is based on a 40 hour work week occurring within 10 hour days, Monday through Friday, less recognized holidays. The Contractor shall be responsible for additional expenses incurred by the Owner for the Engineer's field representative overtime premium associated with work hours in excess of the 40 hour work week. This cost will be deducted from the Contractor's monthly payment request, and will be $45 per hour. No overtime pay will be charged to the Contractor for work performed at night or on weekends, when, due to operational conditions of the Owner's facilities, the work must be performed during these non-standard work hours.

18.4 Maintenance work normally required for protection of persons, or for protection of the work or property, will be permitted at any time.

18.5 For work during an emergency threatening bodily injury, loss of life, or damage to property refer to Article 19 of these General Conditions.

19. EMERGENCY WORK

19.1 It is the Contractor's responsibility at all times to guard against bodily injury, loss of life, damage to the Owner's property, damage to his/her own work on the site, and damage to

adjacent property. In the case of the development of an emergency which threatens loss of life, injury to persons, or damage to property, it is the Contractor's responsibility to furnish and install all necessary materials and equipment, and to perform all work as could possibly be accomplished to prevent loss of life, bodily injury, or damage to property. In all such cases the Contractor shall immediately notify the Engineer and Owner of the emergency, but he need not wait for advice or authorization from the Engineer or the Owner before proceeding to employ all measures necessary to protect life and property. Nothing stated hereinabove shall be construed as limiting the Contractor's responsibility under the terms and provisions of the General Conditions and other Contract Documents to protect life and property and to pay claims resulting from loss of life, bodily injury, or damage to property. The substance of this Article of the General Conditions is that, in case of an emergency, the Contractor will act reasonably and responsibly with all speed, with all force, and in an expeditious manner, to avert loss of life, bodily injury, and property damage.

20. CHANGES IN WORK

20.1 The Owner shall have the right to make additions, deletions, or changes to the work, and to require the Contractor to perform Extra Work. These may be accomplished by Change Order, Construction Change Directive, or by written order for minor changes in the work, and shall be performed under applicable provisions of the Contract Documents. If the Contractor believes that any addition, deletion, change, or Extra Work entitles the Contractor to additional compensation or a time extension, then the Contractor shall so notify the Engineer and the Owner in writing within seven days after the addition, deletion, change, or Extra Work is first proposed, and then shall not proceed unless he thereafter receives a written directive to do so that is signed by the Engineer and the Owner. The Contractor shall not be entitled to any additional compensation or additional time unless he has fully complied with these requirements. Such increases, decreases, changes, and Extra Work shall not invalidate the Contract.

20.2 Where new items of work which could not have been anticipated are found to be necessary for the satisfactory completion of the project, and where the character of the work is such that a reasonable price for the performance of the work cannot be established by use of contract prices or combinations thereof, such new and unanticipatable items of work shall be classed as Extra Work. No Extra Work shall be undertaken except by written order in the form of a Change Order or Construction Change Directive signed by the Engineer and the Owner. The Contractor shall, upon receipt of written order from the Owner, perform such Extra Work and furnish such materials as may be required for the proper completion of construction of the whole work contemplated. In the absence of such written order no claim for extra compensation or a time extension by reason of performance of Extra Work shall be allowed. Extra Work shall be performed in accordance with the Contract Documents, insofar as they are applicable; and where such Extra Work is not covered by the Contract Documents, the performance of the work shall be consistent with the intent of these Contract Documents.

21. FAULTY WORK AND DEFECTIVE WORK

21.1 The performance of satisfactory work that complies with and conforms to all requirements and provisions of the Contract Documents is the obligation of the Contractor, and the Contractor hereby provides the Owner a warranty and guaranty against faulty and defective work. Any faulty work or defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, will neither be accepted nor paid for and shall constitute a breach of the Contractor’s warranty and guaranty. The terms “faulty work” or “defective work” include, but are not limited to: (1)

any product, material, system, process, equipment, or service, or its installation or performance, which does not conform strictly to the requirements of the Contract Documents, (2) in-progress or completed work the workmanship of which does not conform to the quality specified and also to the quality produced by skilled workers performing work of a similar nature on similar projects in the state, (3) substitutions and deviations not properly submitted and approved or otherwise authorized by the Owner, (4) materials or equipment rendered unsuitable for incorporation into the work due to improper storage or protection or other causes; and (5) any work that does not fulfill its intended function and purpose. The Contractor and its performance bond surety shall bear and be responsible for all losses, damages, costs, and expenses related to faulty or defective work, including but not limited to: (a) correction, remediation, or replacement of the faulty or defective work; (b) additional testing and inspections, including repeating specified inspections and tests, (c) reasonable services and expenses of the Engineer, and (d) the expense of making good all work done by the Contractor, Owner, or separate contractors which is destroyed, damaged, or altered by the correction of the faulty or defective work. Payment for faulty or defective work will not be made until such work has been removed, re-executed, and corrected in a manner and form satisfactory to the Engineer and the Owner and in accordance with the Contract Documents. The existence of any known faulty or defective work will prevent the acceptance of the work. The fact that the Engineer may have previously inspected and failed to reject such faulty or defective work shall not constitute acceptance of any part of it. Neither the failure by the Engineer to discover faulty or defective work prior to the making of final payment by the Owner to the Contractor, nor the discovery or appearance of faulty or defective work after the making of said final payment, shall relieve the Contractor (or his/her performance bond surety) of responsibility for faulty or defective work.

21.2 If the Contractor fails to correct faulty or defective work within a reasonable time to the satisfaction of the Engineer, then the Owner may, at the Owner's sole discretion, and upon written notice to the Contractor, have the faulty or defective work corrected by others and recover all losses, damages, costs, and expenses associated with the correction of the faulty or defective from the Contractor and its performance bond surety.

22. UNCOVERING WORK

22.1 If any portion of the work is covered by the Contractor or his/her subcontractors contrary to the requirements expressed in the Contract Documents or the Engineer's specific request, it shall be uncovered for the Engineer's observation and recovered at the Contractor's expense without change in the Contract Amount or time for completion.

22.2 The Engineer may request to see covered work which has not been specifically requested by the Contract Documents or the Engineer to remain uncovered until observed by the Engineer. If such work has been properly installed according to the Contract Documents, then the actual direct costs for uncovering and replacement shall be charged to the Owner. However, if such work is in whole or in part not in accordance with the Contract Documents, then the Contractor shall bear all costs for uncovering and replacement.

23. USE OF COMPLETED PORTIONS OF THE WORK

23.1 The Owner shall have the right to take possession of and use any completed or partially completed portion of the work, provided all insurers and authorized public authorities having jurisdiction over the project consent to this partial possession and use, notwithstanding that the time for completing the entire work or such portions of the work may not have expired; but such taking possession and use shall not be deemed to be acceptance of any work not completed in accordance with the Contract Documents. The

Owner and the Contractor shall agree in writing on the equitable assignment of security, maintenance, utilities, commencement of warranties, insurance and damages to the areas of work to be used by the Owner. If the Contractor believes that any such prior use will increase the cost of, or delay the completion of, uncompleted work, or cause re-finishing of completed work subjected to such prior use, then the Contractor shall so notify the Engineer and the Owner in writing promptly and before the prior use begins. The Contractor shall not be entitled to extra compensation or an extension of time on account of any such prior use unless the Contractor has complied with this requirement, and the Contractor and the Owner have mutually agreed upon such additional compensation or extension of time.

23.2 Prior to occupancy or use by the Owner of any partially completed work, the Owner, the Contractor and the Engineer shall inspect the portion of work to be occupied and used by the Owner to record the condition of the work.

24. CUTTING AND PATCHING OF WORK

24.1 The Contractor shall perform all necessary cutting and patching as required to connect new work to existing work and as required in new work to properly receive the work of the various trades involved in the entire work; and the Contractor shall restore all such cut and patched work, and shall refinish all surfaces affected by such work, to conditions acceptable to the Engineer. Cutting of the existing work, or any work, in such a manner as would endanger the work, adjacent property, the workmen, or the public, is contrary to the provisions of Article 8, SAFETY.

25. CLEANING UP THE WORK

25.1 During performance of the work, the Contractor shall keep the property and the surrounding areas free from the accumulation of waste materials or rubbish caused by the Contractor's operations. If the Contractor fails to keep the site clean, the Owner may do so at the expense of the Contractor.

25.2 At completion of the work the Contractor shall remove from the property of the Owner, and from all public and private property, all temporary structures, rubbish, and waste materials, and surplus materials resulting from his/her operations or caused to be in such locations by actions of his/her employees, subcontractors, suppliers, or vendors. The Contractor shall remove all of his/her equipment, tools, and supplies from the property of the Owner. The entire work shall be clean and finished as specified. The site shall be clean, true to finished contours given, and improved as specified. The entire work shall be ready for permanent occupancy and/or use before acceptance of the work can become fact. Should the Contractor fail to remove his/her equipment, tools and supplies from the property of the Owner, the Owner shall have the right to remove them at the expense of the Contractor.

26. CONTRACTOR'S RESPONSIBILITY FOR PERFORMANCE AND ACTIONS OF WORKMEN

26.1 The Contractor is responsible for the conduct, performance, acts, and omissions of all persons and entities on the project site who are engaged in work on behalf of the Contractor under this Contract. All workmen should have such skill, training, and experience as will enable them to reliably, safely and properly perform the particular work or task assigned to them. It is in the best interest of the Contractor to terminate the employment of workmen whose performance endangers the safety of other workmen or any person, or results in unsatisfactory work, or contributes to delay in the progress of the

work, before the Contractor bears the burden of re-executing unsatisfactory work and suffers the cost of delays in the prosecution of the work.

26.2 The Contractor may be requested by the Owner to remove or to have removed from the job site for the duration of the project any of his/her employees, or any of his/her subcontractors, or any of the employees of his/her subcontractors, who acts in a disorderly or intemperate manner, or who is abusive to representatives of the Owner or of the Engineer or of any Agency having jurisdiction over the project, or who acts in such a manner as would endanger the safety of any person or of the work, all of which acts could give cause for concern for the safety of any person or of the work, for which safety the Contractor is solely responsible.

27. GUARANTY

27.1 The Contractor warrants and guarantees to the Owner that all of the Contractor's work will strictly comply with the Contract Documents, will be free from faulty work and defective work, and will perform as intended. The Contractor and his/her performance bond surety shall be obligated and liable for the correction of any work that does not comply with this warranty and guaranty, together with the cost of repairing or replacing any other work, equipment, facilities or property damaged in connection with the correction of work that does not comply with this warranty and guaranty, and all losses, damages, and expenses incurred by the Owner as a result of any failure of the Contractor's work to comply with this warranty and guaranty.

27.2 Without limiting any other obligation of the Contractor, including, but not limited to, those provided in Article 21 and those provided in Section 27.1 above, and with without limiting any other right or remedy of the Owner, the Contractor agrees that as a separate and independent affirmative obligation, the Contractor shall return to the project and correct any faulty work, defective work, or work that otherwise does not comply with the Contractor's warranty or guaranty, that is identified within one year after the date that the Final Payment Application is signed by the Owner. This separate and independent obligation shall not be construed as a time limit for enforcement by the Owner of any of the Contractor's warranties, guaranties, or other obligations under the Contract Documents.

27.3 No progress payment or final payment, or certificate of payment, or any provision of the Contract Documents, or partial or entire occupancy or use of the work by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of any responsibility or liability in respect to any warranties, guaranties, or other obligations or responsibilities for faulty work or defective work.

27.4 The Contractor's performance bond surety is bound and liable to the Owner to the same extent as the Contractor for performance of the foregoing warranty and guaranty obligations (and the obligations provided in Article 21), and for any damages arising from any breach of or failure to comply with any such obligations. The Contractor's surety shall remain bound and liable for such obligations and damages notwithstanding the completion or acceptance of the work, final payment, or any otherwise applicable time restrictions or other limitations (including the time for filing suit) recited in the surety's bond.

28. MATERIALS AND EQUIPMENT

28.1 The materials and equipment incorporated or installed in the work shall be new and of good quality, free from defects and irregularities, and shall meet all requirements of the Contract Documents, including, but not limited to, those in Articles 21 and 27 above. All

materials and equipment shall be subject to review by the Engineer, and no materials and equipment shall be ordered until information relating to such materials and equipment has been reviewed by the Engineer. The Contractor shall be responsible for furnishing and installing all materials and equipment required for the complete work, and all materials and equipment so furnished and installed shall be warranted and guaranteed by the Contractor in accordance with the provisions of Articles 21 and 27 above.

28.2 It is essential that all material, manufactured articles, and equipment be applied, installed, erected, connected, cleaned, conditioned for use and placed in service in accordance with the instructions of the particular manufacturer of such materials, articles, and equipment.

28.3 Only those manufactured and fabricated items fully complying with applicable standards of the Occupational Safety and Health Administration may be offered, and the manufacturer's or fabricator's certificate to that effect will be required with the submittal of each item by the Contractor.

28.4 Items of equipment, articles or materials which are not equal to samples reviewed by the Engineer, do not conform to the requirements of the Drawings or Specifications or the requirements of applicable standards, or are in any way unsatisfactory or unsuitable for the purpose or service for which they are intended, shall neither be furnished nor installed.

28.5 In order to establish standards of quality, the detailed Specifications, or the Drawings, may include references to certain products by name or by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equivalent or better quality as manufactured by other companies, unless specifically stated that no other manufacturers will be acceptable. Materials or articles which, according to the judgment of the Engineer, will fully meet the design criteria, are equivalent in function and durability, and are suitable for use in arrangement as shown on the Drawings, may be acceptable.

28.6 It must be understood that equipment and articles of different manufacturers, although they may be equivalent in construction, quality, durability and performance, may not have the same dimensions, configurations and arrangement of connections. It then becomes the responsibility of the Contractor to take into consideration any variations in dimensions and connection arrangement of the equipment or articles that he proposes to offer from those of equipment shown on the Drawings, or called for in the Specifications, and make certain that the proposed equipment or article can be installed in a neat and efficient arrangement in the space available. In the layout of the equipment and connections thereto, accessibility for proper maintenance is a requirement in order to ensure satisfactory operation.

28.7 Substitution of equipment, articles or materials other than those shown on the Drawings or specifically named in the Specifications, when requested by the Contractor, will be considered, provided that the design and construction of such equipment, articles, or materials establish that they will meet the requirements of the Specifications and Drawings. By tender of a request for a substitution, the Contractor represents that he has fully investigated and analyzed the product, and that he guarantees that the product will fully meet the design criteria of the product specified, has the durability and life expectancy of the product specified, is equivalent in function and performance to the product specified, and is suitable for installation in efficient arrangement in the space shown on the Drawings. The Engineer will review the proposed substitutions and make his/her recommendations within a timely manner as defined below. The Contractor shall abide by the Engineer's decision when proposed substitute equipment, articles or materials are not recommended for installation and, in such case, shall furnish the specified article, item of equipment or

material. The decision of the Engineer to accept the substitute product shall not relieve the Contractor of his/her warranty, guaranty, and other obligations provided in the Contract Documents with respect to the Contractor's work.

28.8 In order to be considered by the Engineer, any request by the Contractor for substitution of products must be made in a timely manner. By "timely" it is meant that any such requests should be made as early after the commencement of the work as is possible so that sufficient time will be allowed for: review by the Engineer along with review of other submittals in connection with the project; in case of rejection of the submittal, preparation of succeeding submittals covering other substitute products; reviews of the succeeding submittals; ordering and manufacture of an acceptable product; delivery of product to job site well in advance of the time that it is scheduled to be installed.

29. SHOP DRAWINGS AND PRODUCT DATA

29.1 Shop drawings are drawings, diagrams, and other data prepared for the work by the Contractor, subcontractor, or supplier to illustrate some portion of the work. Product data are illustrations, schedules, charts, brochures, instructions or other information furnished by the Contractor, subcontractor, or supplier to illustrate materials or equipment for some portion of the work. Shop drawings and product data are submitted to demonstrate how the Contractor proposes to conform to the requirements of the Contract Documents.

29.2 The Contractor shall provide all shop drawings and product data as may be necessary for the proper and satisfactory prosecution of the work, all in accordance with the intent of the Contract Documents to secure a complete and operable project capable of satisfactory performance of the service intended. The shop drawings and product data shall be submitted in accordance with an orderly schedule based upon time required for review, approval, ordering, and fabrication or manufacture, and delivery, and upon the time at which materials, fabricated items, or manufactured items will be required to be incorporated in the work. The Contractor shall perform no portion of the work requiring submittal and review of shop drawings and product data prior to receipt of the Engineer's approval. Ordering material or equipment by the Contractor prior to receipt of concurrence from the Engineer will be fully at the Contractor's risk, even if the materials or equipment ordered are identical to the items listed in the Specifications or shown or the Drawings. No consideration will be made for reimbursement to the Contractor for restocking fees, purchase costs, delivery costs, or any other expenses caused by the Contractor's decision to place premature orders for materials or equipment.

29.3 The Engineer's review of shop drawings is not intended to verify the accuracy and completeness of details such as dimensions and quantities or to substantiate installation instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor. Deviations from the Contract Documents shall be specifically and conspicuously called to the attention of the Engineer by the Contractor at the time when such shop drawings or product data are first submitted to the Engineer for his/her consideration. The Engineer's review of any drawings shall not release the Contractor from responsibility for such deviations, or any subsequent deviations not noted by the Contractor or the Engineer.

29.4 During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and

installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall confirm the following:

1. The materials, products, and equipment being supplied are of the correct size, materials and type
2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
3. The products/equipment being supplied are intended for use in this application.

All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.

Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they comply with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all sizes, dimensions, locations, field measurements, construction criteria, materials, catalog numbers, and similar data. Field dimensions, sizes and other pertinent information shall be clearly shown on the shop drawings/submittals. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's warranty and guaranty will fully apply.

29.5 All shop drawings and product data submitted to the Engineer shall be numbered by the Contractor using a three part numbering methodology. The three part number shall include a submittal number, the specification section number where the submitted item is described, and an indication of whether the information is an initial submittal or a resubmittal.

30. PROJECT RECORD DOCUMENTS

30.1 The Contractor shall maintain at the site one record copy of the Contract Documents, approved Shop Drawings, Product Data, Samples and other required submittals. These are to be in good order and marked to record changes made during construction. When required in other Division 1 sections (Project Record Documents and/or Project Closeout Procedures), the Contractor shall, upon Substantial Completion and prior to Final Completion, engage a licensed surveyor to perform a topographic and planimetric survey as required to document/record the “as-built” location of the Work. The survey shall be provided in digital (CAD/dwg or dgn) format. All site documents shall be delivered to the Engineer for submittal to the Owner at the completion of the work.

31. TEST REPORTS AND CERTIFICATES

31.1 Certified statements of compliance, where required by the Specifications, shall be furnished by the Contractor.

31.2 Certified mill test reports, where required by the Specifications, shall be furnished by the Contractor.

32. STORAGE OF MATERIALS AND/OR EQUIPMENT

32.1 Materials or equipment to be incorporated in the work shall be properly housed or otherwise protected from corrosion and damage so as to ensure the preservation of their finish, quality, and fitness for the work, all in accordance with the manufacturer's recommendations. Where considered necessary to secure proper protection, the materials shall be placed on racks, platforms, or hard clean surfaces not subject to surface drainage or excessive moisture. Factory finished items shall be stored above ground, covered, individually sealed, or housed indoors as required. Materials not properly stored, housed and maintained in condition for service as intended will neither be paid for as stored materials nor as materials incorporated in the work.

32.2 Stored materials and equipment shall be located and arranged so as to facilitate observation. Private property shall not be used for storage purposes without the written consent of the owner or lessee of said property. When the Contractor desires to accept delivery of material or equipment which cannot be accommodated or housed on the site of the work he may, but only with the permission of the Engineer and the Owner, store such material and/or equipment in an adequately insured warehouse. Any agreement for rental of such storage space by the Contractor shall contain a provision that the material and/or equipment thus stored shall not be subject to a lien for payment of storage. The Owner shall be protected against loss of or damage to such stored equipment by the terms and endorsements of the Contractor's insurance policies.

33. LANDS AND RIGHTS-OF-WAY

33.1 The Owner will provide the lands (property, easements and /or rights-of-way) shown on the Drawings, or described in the Specifications, upon which the work under the Contract is to be performed, and which are to be used for access to the work. Any delay in furnishing these lands by the Owner that would prevent the Contractor from beginning the work or continuing the prosecution of the work, may be deemed to be proper cause for adjustment of the time for completion of the work or for adjustment of the Contract Amount.

33.2 Any land and access thereto not specifically shown to be furnished by the Owner that may be required for temporary construction facilities or for storage of materials shall be provided by the Contractor with no cost or liability to the Owner. The Contractor shall confine his/her equipment, apparatus, and storage to such additional areas as he may provide at his/her own expense.

33.3 The Contractor shall not enter upon private property for any purpose without obtaining permission; and the Contractor shall be responsible for the preservation of all public property, trees, monuments, structures and improvements, along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall use suitable precautions to prevent damage to pipes, conduits, other underground structures, and utilities. The Contractor shall carefully protect from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location; shall not remove such monuments and property marks until authorized to do so; and, in the event that they should be removed, shall replace them in original location when the work in the area has been completed.

34. ACCESS TO THE WORK

34.1 The Engineer and his/her representatives shall have free access to the work at all times and shall be given full opportunity to observe the work in progress and to examine such

records of the Contractor as may have bearing on the proper review and observation of the work. The Contractor shall provide at the site of the work such space as would be reasonably adequate to serve as a field office for representatives of the Engineer and as storage area for their equipment and supplies.

35. OBSERVATION OF THE WORK

35.1 The Engineer will decide questions which may arise as to the quality and acceptability of materials and/or equipment furnished, the quality and acceptability of work performed, interpretations of the Contract Documents, and all questions with respect to the acceptable fulfillment of the Contract on the part of the Contractor. The Contractor shall abide by these decisions. The duties and responsibilities of the Engineer as set forth herein shall not be extended except through signed written consent of the Engineer and the Owner.

35.2 All materials and each part or detail of the work shall be subject at all times to observation by the Engineer and the Owner, and the Contractor shall be held strictly to the intent of the Contract Documents in regard to quality of materials, equipment and workmanship, and also in regard to the diligent execution of the Contract. Observations may be made at the site, or at the sources of supply, of material whether mill, plant or shop. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make his/her observations and construction review.

35.3 The Engineer's decision as to the acceptability or adequacy of the work shall be final and binding upon the Contractor. The Contractor agrees to abide by the Engineer's decision relative to the performance of the work.

35.4 All claims made by the Contractor shall be submitted to the Engineer for his/her decisions. Such decisions shall be final except that, in cases where time and/or financial considerations are involved, the claims shall also be submitted to the Owner for his/her review and shall be subject to the approval of the Owner. Meritorious claims shall be resolved, if possible, by mutual agreement between the Contractor and the Owner. Regardless of whether the Engineer or the Owner has actual or constructive notice of any claim of the Contractor for additional compensation, time, or other consideration, the Contractor agrees that such claim is waived and forfeited unless it is set forth in detail in a written notice to the Engineer, and delivered to the Engineer as soon as practicable in the circumstances, but in any event no later than ten days after the first occurrence of any of the conditions out of which such claim arises.

35.5 During the construction of the work, as defined by the Drawings and Specifications therefor, the Owner/Engineer may assign a Field Representative to the project. The duties of the Field Representative shall consist of visual review of materials, equipment and construction work for the purpose of ascertaining that the product of the Contractor's work conforms to the Drawings and is conformance with the intent of the Specifications for the project. The presence of the Field Representative at the site of the work shall not be relied upon by others as acceptance of the work, nor shall it be so construed as to relieve the Contractor in any way from his/her obligations and responsibilities under the Contract Documents. Review of the construction work by the Field Representative or by the Engineer shall not require either the Engineer or the Field Representative to assume responsibilities for the means and methods of construction nor for safety on the project site, in areas adjacent to the project site, or in other areas affected by the work performed on the project.

36. SCHEDULE OF VALUES & UNIT PRICES

36.1 The Contractor shall, within ten days of receipt of Notice to Proceed, submit a Schedule of Values showing the value assigned to each part of the work, the total of the assigned values of all parts or components being equal to the total Contract Price. The Schedule of Values shall be consistent with the line item amounts in the Contractor's Proposal form. Such breakdown, or division of the work into parts or components according to trades or sections of the Specifications, shall have the concurrence of the Engineer before being used as the basis for estimating partial payments for work performed under the Contract. No partial payment will be made to the Contractor until an acceptable Schedule of Values is approved by the Owner. The costs shown in the Schedule of Values shall not, however, be considered as fixing a basis for additions to or deductions from the Contract Price, nor shall they be considered as fixing a basis for computing the cost of Extra Work.

36.2 The Schedule of Values shall correlate with the construction categories which make up the Application for Payment and shall be updated and resubmitted when a Change Order or Construction Change Directive is issued which results in a change to the Contract Amount.

36.3 Where unit prices form the basis for payment under the Contract, such unit prices as set forth in the Proposal, when applied to the corresponding quantities of work performed during a given estimate period, shall represent the value of work performed during that estimate period. It shall be understood, however, that the estimated quantities of work shown in the Proposal to be paid for on unit price basis are given for the purposes of determining the approximate value of the work and comparing bids, that the Owner reserves the right to increase or decrease the estimated quantities of work as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated under this Contract, and that such increase or decrease in the estimated quantities of work shall in no way, either vitiate this Contract or give cause for claims or liability for damages.

37. APPLICATIONS FOR PAYMENT

37.1 No later than the fifth (5th) calendar day of each month (or the next business day if such date falls on a weekend or legal holiday), and not more often than once a month, the Contractor shall submit to the Engineer for review an Application for Payment filled out and signed by Contractor covering the work completed as of the date of the end of the preceding month, accompanied by such supporting documentation as is required by the Contract Documents or otherwise reasonably requested by the Engineer. If payment is requested on the basis of materials and equipment not incorporated in the work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that the Owner has received the materials and equipment free and clear of all liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to the Engineer and the Owner. The Contractor shall submit three (3) executed copies of each Application for Payment to the Engineer. The Contractor shall complete every entry on the form, including notarization and execution by the person authorized to sign legal documents on behalf of the Contractor. Amounts of Change Orders and Construction Change Directives approved prior to the last day of the construction period covered by the Application shall be included. Entries shall match the data on the Schedule of Values and the construction schedule, and shall include waivers of mechanics liens and similar attachments when required by the Owner.

37.2 The Engineer's review and recommendation of the Contractor's Application for Payment shall be subject to the following:

A. That the Contractor or his/her superintendent on the work shall have agreed with the representative of the Engineer regarding value of work performed during the period covered by the Application for Payment before the Application for Payment is submitted to the Engineer.

B. That the payment application contains a line item for each of the following deductions:

1. Costs incurred by the Owner/Engineer due to Saturday/Sunday/Holiday/Overtime Work.
2. Other miscellaneous costs incurred by the Owner/Engineer (due to re-inspection, rework, evaluation due to insufficient documentation of claims for weather delays, etc.).
3. Liquidated Damages for missing the Substantial Completion Date
4. Liquidated Damages for missing the Final Completion Date

The Contractor shall obtain these costs from the Owner/Engineer each month and incorporate them into the estimate (pay application) before submitting the estimate to the Engineer for review.

C. That payment may not be made for work on which satisfactory test reports have not been received before the submittal of the Application for Payment.

D. That payment shall not be made for defective work or for faulty work not completely corrected before the submittal of the Application for Payment.

E. That retainage of 5% shall be withheld until 50% of the work, including the value of materials and/or equipment stored, has been completed to the satisfaction of the Engineer and the Owner, after which no additional deductions for retainage will be made from the succeeding periodic payments made to the Contractor. Retainage shall be withheld until the Contract has been completed and the work has been accepted, subject, however, to other provisions of these General Conditions.

Should the Contractor fail at any time to maintain satisfactory progress and quality of work, the five percent (5%) retainage will be reinstated until the progress and quality of work is consistent with the Contract Documents.

F. That, following a certification by the Engineer that the work has been substantially completed in accordance with the provisions of the Contract Documents but has not yet been fully completed and accepted, the retainage may be reduced to such an amount as would reasonably cover 150% the cost of correction and completion of minor items of work found to be faulty or incomplete and the cost of the work remaining to be done in order to effect the completion of all of the work in full accordance with the provisions of the Contract Documents. The consent of the Surety shall be obtained prior to any reduction in retainage.

G. That in addition to retainage, the amount otherwise due on any Application for Payment may be reduced by amounts reasonably necessary to protect the Owner from any loss, cost, or expense that might arise from: (1) any faulty work, defective

work, or work that does not comply with the Contractor's warranty and guaranty; (2) existing or anticipated claims against the Owner arising from the work; (3) reasonable evidence that the work cannot be completed for the unpaid balance of the Contract Amount; (4) reasonable evidence that the work cannot be completed within the time allowed by the Contract; or (5) any failure by the Contractor to strictly comply with any requirement or obligation provided in the Contract Documents.

37.3 Ten days after submission of the Application for Payment to the Owner with Engineer's certification and recommendation, the amount recommended and certified by the Engineer will become due and when due will be paid by the Owner to the Contractor.

37.4 The value of preparatory work done and the value of materials and/or equipment stored in accordance with the Contract Documents may be taken into consideration in the preparation of estimates, provided that materials stored meet the requirements of the Contract Documents.

37.5 The Contractor shall timely pay all bills, invoices, and charges for all labor, services, work, equipment, and materials acquired or used by the Contractor for the work. The Contractor agrees that he will indemnify and save the Owner harmless from all claims arising out of the lawful demands of subcontractors, laborers, workmen, mechanics, and suppliers of machinery, parts, equipment, power tools, fuel, materials and other construction items, incurred in the performance of work under this Contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature hereinabove described have been paid, discharged, or waived. If the Contractor should fail to do so, then the Owner may, after having served written notice on the Contractor, either directly pay those unpaid bills of which the Owner has received written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is presented that all such liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in accordance with the terms of this Contract, but, in no event, shall the provisions of this sentence be construed to impress upon the Owner any obligations to the Contractor, his/her surety, or to any of the Contractor's subcontractors, laborers, workmen, mechanics, or suppliers of any tier. In paying any unpaid bills of the Contractor, the Owner shall be deemed to be the temporary agent of the Contractor for this specified purpose; and any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

38. PAYMENT FOR MATERIALS STORED

38.1 Payment for materials and equipment stored shall be subject to the requirements of these General Conditions.

38.2 No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or security agreement, or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials, equipment, and supplies used by him/her in the work, and that such title is free from all liens, claims or encumbrances.

38.3 Payment for materials stored may be conditioned upon evidence submitted to establish the Contractor's title to materials and/or equipment stored, such as paid invoices, receipts of payment, satisfied purchase agreements, etc. When value of materials stored is

allowed to be included in the Contractor's periodic estimates, the materials and/or equipment represented by such value shall become the property of the Owner, and the Contractor shall be responsible for safeguarding and using such materials and/or equipment in accordance with the provisions of the Contract Documents and shall retain all risk of loss or damage.

39. PAYMENT FOR EXTRA WORK

39.1 Extra Work shall be undertaken and prosecuted in accordance with the provisions of Article 20 of these General Conditions.

39.2 Payment for Extra Work may be made by use of one of the following methods:

A. Unit prices or combinations of unit prices which formed the basis of the original Contract.

B. A lump sum based upon the Contractor's estimate and accepted in writing (and signed) by the Owner.

C. Work Performed by the Contractor: Actual direct costs incurred solely, reasonably, and necessarily to perform the work plus fifteen percent (15%) of such actual direct cost to cover supervision, overhead, bond, other indirect costs, and profit. The Contractor shall submit to the Engineer and the Owner itemized cost sheets and documentation establishing the actual direct costs of performance of the Extra Work. Actual direct costs are defined as follows:

1. Actual documented labor costs, excluding supervisory personnel except for any time such personnel are at the project solely to supervise performance of the Extra Work and not for any other purpose.

2. Actual Labor-based Insurance and Workmen's Compensation Benefits costs attributable solely to labor actually and necessarily engaged in the performance of the Extra Work.

3. Social Security and unemployment contributions required by law for labor actually and necessarily engaged in the performance of the Extra Work.

4. Rental costs and charges for construction plant and/or equipment while actually and necessarily used in the performance of the Extra Work. Such costs or charges shall not exceed the lesser of AED Green Book standard rental rates, rental rates prevailing in the area of the work, or the Contractor’s internal job cost charges for such equipment. For equipment that is also on the project for work other than the Extra Work, only the documented time that such equipment is actually and necessarily engaged in performance of the Extra Work may be included, and no stand-by or idle time may be included. Daily rates shall be determined by dividing monthly rates by twenty-two (22); and hourly rates shall be determined by dividing monthly rates by one hundred and seventy-six (176). Rental rates or use rates shall not be charged for equipment having a value of less than $100.00 since equipment and tools having values of less than $100.00 are classed as small tools and as such are considered to be part of overhead.

5. Actual documented costs of materials and/or equipment entering permanently into the work.

6. Actual documented costs of power and consumable supplies for the operation of power equipment where such costs are not included in rental rates or use charges, and only for the incremental portions of such charges that are shown to have resulted solely from uses that were actually and necessarily required for performance of the Extra Work.

D. Work Performed by a Subcontractor for the Contractor: The Contractor shall eligible to receive five (5%) percent of its subcontractors' direct costs that are incurred solely, necessarily, reasonably to perform the Extra Work to cover all of the Contractor's costs of insurance, supervision, management, and other indirect costs. The subcontractor shall be entitled to its documented actual direct costs incurred solely, reasonably, and necessarily to perform the Extra Work plus fifteen percent (15%) of such actual direct costs to cover supervision, overhead, bond, other indirect costs, and profit. The Contractor shall submit to the Engineer and Owner itemized cost documentation showing the subcontractor's actual direct costs of performance of the work. Actual costs are defined above in C.1. through C.6 above.

40. SUBSTANTIAL COMPLETION

40.1 Substantial Completion is the point at which all (or a portion designated by the Engineer and the Owner) of the work has been sufficiently completed in accordance with the Contract Documents so the Owner can occupy and use the work for its intended purpose without any limitations or restrictions. Generally, and unless specifically stated otherwise in the Contract Documents, Substantial Completion must include all significant Work items such as demolition, site work, piping/utilities, equipment, concrete, masonry, buildings, miscellaneous metals, instrumentation and controls, fencing/gates, lighting/electrical, and access roads. Unless otherwise specifically stated in the Contract Documents, Substantial Completion does not include minor items such as signage, grassing, minor repairs and/or adjustments that do not affect performance/operation or use of the facilities, and other punch-list items.

On occasion, the Owner will designate a portion of the Work to be substantially complete so it can be occupied/placed into service, but this does not relieve the Contractor of responsibility achieve Substantial Completion and Final Completion on the remainder of the Work in accordance with the Contract Documents.

40.2 When the Contractor considers the work to be substantially complete, then the Engineer will observe the Work to determine whether or not the Owner will accept the work as being substantially complete. Repeat inspections, if required, will be performed by the Engineer at the Contractor's expense. The Engineer will notify the Owner when in the judgement of the Engineer the Work has reached substantial completion. The Owner may then elect to accept the Work as substantially complete, and the Engineer will issue a written Certificate of Substantial Completion.

40.3 Final Completion: After written Substantial Completion has been achieved, the Contractor and the Engineer will develop a list ("punch list") of remaining work items that must be completed in order to achieve Final Completion. Repeat "punch list" inspections, if required, will be performed by the Engineer at the Contractor's expense. Once the Contractor has completed all of the Work items (including punch list items) in accordance with the Contract Documents, the Engineer will notify the Owner when in the judgement of the Engineer the Work has reached Final Completion. The Owner may then elect to

accept the Work as complete, and the Engineer will issue a written Certificate of Final Completion.

Additional requirements relating to Substantial Completion are contained in other sections of these General Conditions and in Division 1 sections of the Specifications.

40.4 Failure of the Contractor or the Engineer to include an item on the list of items to be completed for final acceptance does not alter the Contractor's responsibility to complete all work in accordance with the Contract Documents, or limit the Contractor's warranty or guaranty.

41. ACCEPTANCE AND FINAL PAYMENT

41.1 When the Contractor shall have completed all of the work in accordance with the terms of the Contract Documents, he shall so certify to the Engineer and the Owner that he has completed all of the work in accordance with the provisions of the Contract Documents. The Contractor shall also prepare and submit to the Owner a Final Request for Payment in an amount which shall be the Contract Amount plus all approved additions, less all approved deductions and less previous payments made.

41.2 The Contractor shall give notice of the completion of the work by advertisement in a newspaper of general circulation in the area in which the work has been performed and said notice shall appear once each week for a period of four (4) consecutive weeks. Proof of publication of said notice shall be furnished by the Contractor to the Owner by affidavit of the publisher of the newspaper, to which affidavit shall be attached a copy of the Notice.

41.3 When the Owner and the Engineer have completed a review of the work and of the request for final payment, and have determined that all of the work appears to completed in accordance with the provisions of the Contract Documents, final payment of the amount determined to be due under the Contract will be made to the Contractor, provided that:

A. Any deficiencies in the work, including outstanding warranty work, noted during the review shall have been satisfactorily corrected.

B. Final acceptance has been achieved.

C. The Contractor shall have submitted satisfactory evidence that all payrolls, all amounts due for labor and materials, and all other indebtedness connected with the work shall have been fully paid and satisfied; that there are no outstanding claims or demands against the Contractor in any manner connected with the work; submitted written consent of the Contractor's surety to final payment; and performed all other requirements relating to final acceptance as contained in other sections of these General Conditions and in Division 1 sections of the Specifications.

D. The Contractor shall have submitted an Affidavit of Release of Liens, and Affidavit of Payment of Debts and Claims, both as outlined below; and satisfactory evidence that there are not outstanding claims or demands against the Contractor in any manner connected with the work.

1. The Affidavit of Release of Liens shall include the following wording:
"The undersigned hereby certifies to the best of his/her knowledge, information, and belief, the Releases of Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and

equipment, and all performers of work, labor, or services who have or may have liens against any property of the Owner arising in any manner out of the performance of the referenced Contract."

2. The Affidavit of Payment of Debts and Claims shall include the following wording:
"The undersigned hereby certifies that he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and service performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced for which the Owner or his/her property might in any way be held responsible."

41.4 Final acceptance of the work shall be achieved (a) when all punch list items are accounted for by their completion or correction by the Contractor and acceptance by the Engineer and the Owner and, (b) all then-known warranty items have been satisfactorily addressed.

41.5 Acceptance of final payment by the Contractor shall be, and shall operate as, a release of the Owner from all claims and all liability to the Contractor for all things done or furnished in connection with the work, and for every act and neglect of the Owner and others relating to or arising out of the work. No payments, final or otherwise, shall release the Contractor or his/her sureties from any obligations under this Contract or under the Performance and Payment Bonds.

42. TESTS AND INSPECTIONS

42.1 Tests, inspections and approvals of portions of the work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at appropriate times. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing entity acceptable to the Engineer, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals.

43. TESTING OF COMPLETED WORK

43.1 After completion of the work and before acceptance of the work by the Owner, the Contractor shall perform all tests as required by the Specifications. The cost of all labor, tools, materials and equipment necessary for making the required tests, including the initial supply of treatment chemicals from a vendor approved by the Engineer, shall be borne by the Contractor. Any work found to be defective, faulty, or otherwise unsatisfactory shall be corrected by the Contractor without additional compensation. All work shall be guaranteed against defects as provided in the Contract Documents.

44. INCIDENTALS ABSORBED

44.1 All work and material covered by the Specifications or the Drawings, and any work, materials, or equipment that may be reasonably inferable from the information given upon Drawings or in the Specifications and that is necessary to complete the work or for the work to function and perform as intended, together with any tools, or appliances, or structures that may be needed or constructed by the Contractor for carrying out the work, shall be furnished by the Contractor, and the cost of all of the above shall be included in and absorbed by the prices and amounts included in the Contractor's Proposal.

44.2 The Contractor shall arrange and pay for all water, power, gas, sewer, telephone, cable, or other utility services used in his/her construction operations. The Contractor shall also establish and pay for all temporary/permanent utility services for the work until acceptance of the completed work by the Owner.

45. ASSIGNMENT OF CONTRACT

45.1 The Contractor shall not assign his/her Contract, nor any part thereof, nor any monies due, or to become due hereunder, without prior written consent of the Owner. In case the Contractor, with the consent of the Owner, assigns any or all of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to valid claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of work under this Contract.

46. ORAL AGREEMENTS

46.1 No oral order, objection, claim or notice given by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and no condition, requirement, obligation, right, or remedy in the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed upon waiver or modification made in writing and signed by the party against whom the waiver or modification is to be enforced, and no evidence of any other waiver or modification shall be introduced in any proceeding.

47. NOTICE AND SERVICE THEREOF

47.1 All notices, demands, requests, instructions, approvals and claims shall be in writing.

47.2 Any notice to or demand upon the Contractor shall be sufficiently given if actually received (including receipt via email) or if delivered at the local office of the Contractor, or by personal service upon the Contractor's superintendent or project manager assigned to the work, or by certified or registered United States mail in a properly addressed sealed envelope with sufficient postage prepaid, or by delivery to a reputable overnight courier with charges prepaid and addressed to the Contractor at the address stated by the Contractor in the Proposal, or at the local address used by the Contractor during the process of the work (or at such other address as the Contractor may from time to time designate to the Owner in writing). Any notice to or demand upon the Owner shall be sufficiently given only if delivered to both the Owner and the Engineer at the addresses provided in the Contract Documents by one of the methods described above.

48. SUSPENSION OF WORK

48.1 The Owner shall have the right to suspend the work, wholly or in part, for such periods of time as he may deem necessary. The Contractor may be eligible for an equitable adjustment of the time for completion and/or the Contract Amount for direct costs or delays unavoidably caused solely by the suspension, unless the suspension was attributable in whole or in part to the performance or non-performance of the Contractor or unless an adjustment in the time for completion or the Contract Amount is made or denied under another provision of the Contract Documents.

49. TERMINATION FOR BREACH

49.1 In the event that the Contractor (including his/her subcontractors or vendors of any tier) violates or fails strictly to comply with any obligation or requirement in the Contract Documents, the Owner may serve written notice upon the Contractor and his/her surety of its intention to terminate the Contract or exercise any other remedy allowed by or provided in the Contract Documents, such notices to be signed by the Owner and to contain the reasons for such intentions. Unless within ten days after serving of such notice upon the Contractor such violation or non-compliance is cured in a manner satisfactory to the Owner and the Engineer, the Owner exercise any remedy allowed by or provided in the Contract Documents, or the Owner may terminate the Contract by giving to the Contractor notice of such termination for the reasons stated in the initial notice. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Contractor's surety.

49.2 The Owner may terminate the Contract if the Contractor persistently fails to supply enough properly skilled workers or proper materials; fails to maintain the construction schedule; persistently performs faulty or defective work; fails to promptly remedy any faulty work or defective work; fails to make payment to subcontractors, suppliers, or vendors for materials or labor; disregards laws, ordinances or regulations of a public authority having jurisdiction; or otherwise is guilty of substantial breach of a provision of the Contract Documents.

50. ADDITIONAL OR SUBSTITUTE BONDS

50.1 If, at any time after the execution of the Contract Agreement and the Surety Bonds attached thereto, the Owner should, for justifiable cause, deem the Surety or Sureties then upon the Performance and/or Payment Bonds, to be unsatisfactory, the Contractor shall within five (5) days after notice from the Owner to do so, furnish an acceptable bond (or bonds) in such form as may be satisfactory to the Owner and with such Surety or Sureties as may be satisfactory to the Owner. The premiums on such bond (or bonds) shall be paid for by the Contractor. No further payments to the Contractor shall be deemed to be due until such new and/or additional security for the performance of the work and/or for the payment for labor and materials shall have been furnished in form and amount satisfactory to the Owner.

51. HAZARDOUS MATERIALS

51.1 The term "hazardous materials" shall mean any substances, including but not limited to asbestos, toxic or hazardous waste, PCBs, combustible gases and materials, petroleum or radioactive materials (as each of these is defined in applicable federal statutes) or any other substances under any conditions and in such quantities as would pose a substantial danger to persons or property exposed to such substances at or near the work site.

51.2 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a hazardous material encountered at the site, then the Contractor shall, upon recognizing the condition, immediately stop work in the affected area and report the condition to the Owner and Engineer in writing.

51.3 The Contractor is responsible for being aware of and complying with the Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP). The Contractor shall perform all work activities in accordance with the Asbestos NESHAP regulation and any other applicable federal, state or local codes, laws, and regulations.

52. SCHEDULE OF WORK

52.1 All activities associated with the work requiring partial or complete shutdown of the existing facilities shall be scheduled by the Contractor and approved the Owner. The schedule approved by the Owner must include the exact time and duration of any and all periods of shutdown of the existing facilities.

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 PROJECT INFORMATION

A. Project Name and Location/Address:
Northport WTP – Filter and SCADA Improvements - Phase I
11580 Larry Lake Rd.
Northport, AL 35476

B. Owner Information:
The City of Northport
3500 McFarland Blvd
Northport, AL 35476

C. Owner Contact:
Kevin Turner
kturner@cityofnorthport.org
11580 Larry Lake Rd.
Northport, AL 35476
205.342.3636

D. Engineer Information
Krebs Engineering, Inc.
Maci McGee
maci.mcgee@krebseng.com
2100 River Haven Drive
Suite 100
Birmingham, AL 35244
205.987.7411

E. Subconsultant Information.
Electrical - Jackson, Renfro and Associates, Inc.
Phil Black, P.E.
phil@jraee.com
205.536.7120

1.1 DESCRIPTION OF WORK INCLUDED IN THIS CONTRACT

A. The Work included in this Contract generally consists of the following:
1. Miscellaneous improvements to the SCADA network.
2. Installation of Filters 1-3 rate of flow controllers, and installation of Filters 4-6 butterfly valves with electric actuators.
3. The requirements of this Section and Division 1 apply to all of the Contract Documents.

1.2 ACCESS TO SITE

A. The Contractor shall have full use of the site unless otherwise stated in the Contract Documents. The Contractor shall limit work activities to areas within the limits of disturbance shown on the Drawings, and shall not disturb areas of the site that are beyond the Limits of Disturbance.

B. The Contractor shall maintain Owner use and access to buildings, driveways and other facilities at all times, unless specific exceptions are included in the Contract Documents.

C. The Contractor shall be solely responsible for protecting all existing and adjacent facilities from construction activities at all times, and shall be responsible for repairing any damage that results from construction of the Work.

1.3 COORDINATION WITH THE OWNER

A. Unless otherwise shown/stated specifically, the Owner will occupy the existing facilities during the construction period.

B. The Contractor shall minimize impacts from construction activities and shall not interfere with Owner's staff and water treatment operations.

C. The Contractor shall coordinate activities such that water treatment plant will only be out of operation for a maximum of 24 consecutive hours. The Contractor must then wait 48 consecutive hours prior to the next scheduled shutdown.

1.4 WORK HOURS AND OTHER RESTRICTIONS

A. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Weekend work will be allowed on a case-by-case basis and as approved in writing by the Owner.
2. Early Morning Hours: Early morning work will be allowed on a case-by-case basis and as approved in writing by the Owner

B. The Contractor shall take all necessary precautions/measures to limit noise, dust, odors and other disruptive impacts to the Owner and/or neighboring properties.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

1.5 WORK SEQUENCE

A. The Water Treatment Plant shall remain in operation for the duration of the project except under the specific shutdowns required for completion of work. It is anticipated

that this will require substantial coordination between the Contractor and Owner as work proceeds in each area of the Plant. The responsibility of temporary facilities and any other coordination/sequencing items shall remain solely that of the Contractor. The Contractor should not proceed with isolating any portion of the Plant without prior written permission from the Owner. The Contractor is made aware the operation of the of the Plant in compliance with all regulatory requirements is the priority of the facility, and as such, work schedules may be altered at any time to accommodate the operation of the Plant. Consideration for additional work due to work stoppage or changes in operational schedule due to the required operation of the Plant, at the sole discretion of the Owner, shall not be considered.

B. The Contractor may only remove one (1) filter from service at a time.

C. The new Filter/SCADA controls must be operational prior to the removal of any of the associated rate of flow controllers and/or actuated valves.

D. The Contractor shall coordinate with the SCADA integrator to keep both filter control systems in operation as the new filter controls are placed into service, one filter (1) at a time.

1.6 PROJECT CLEANING

A. The Contractor shall clean all areas within the water treatment facility disturbed by construction.

1.7 ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Allowance No. 1: SCADA System and Instrumentation:
   1. Purchase Contract Firm and Representatives:
      a. EMC, Inc., James Denton (205) 910-8348
   2. Contract for: Project management, project engineering, manufacturing, instrumentation, PLC programming, and SCADA System configuration to design, build, and commission the new system. Also included is Field Service Labor to provide, startup assistance, calibrations, testing, training, and wire terminations within control panels and instrumentation provided by EMC.
   3. A copy of the agreement and deliverables are included in Appendix A of these documents.

4. The Contractor will supply instrumentation backboards and install all instrumentation supplied by the SCADA Integrator. The Contractor is also responsible for all piping show on the drawings.
5. Purchase Status: The price was negotiated by Owner. An allowance has been noted on the proposal form.

1.8 SCHEDULE OF ALTERNATES

A. The alternates shown in the Proposal Form are listed and described below:

1. Alternate No. 1 – Replacement of a section of surface wash piping in filters No. 1 – 3.
   a. Additive alternate to demolish, furnish and install the section of filter surface wash piping as indicated in the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 26 00 - CONTRACT MODIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for Contract modifications (Change Orders).

B. Change Orders must be in the form of a written document that changes the Contract scope, time, and/or Amount. Change Orders must be signed by the Contractor, Owner, and Engineer. Additional Change Order requirements can be found in the General Conditions.

C. The Engineer may issue instructions for minor changes in the Work without changes to the Contract Time and without changes to the Contract amount. The Engineer may provide job sketches or other additional information for these minor changes. The Contactor shall incorporate the minor changes into the Work in a timely manner.

D. The Contractor shall not stop work or execute the proposed change(s) unless and until a written Change Order has been executed.

1.2 CHANGE ORDER REQUESTS

A. If the Engineer or Owner requests a Change Order, then the Engineer will issue a description of proposed changes in the Work. The Engineer may also provide additional information in the form of drawings or specifications. The Contractor shall submit a proposed Change Order within 14 days of receipt of the Change Order request (unless otherwise specified).

B. Change Order proposals shall include the proposed changes to the Contract Amount and Contract Time. The Change Order proposal(s) shall be detailed, and shall include the following at a minimum:

1. Quantities for materials and equipment.
2. Units and unit costs.
3. Labor man-hours and unit costs.
4. Detailed list of equipment (and hours/days, unit cost for each).
5. Subcontractor costs (include quotes from subcontractors).
6. Vendor/supplier costs (include quotes from vendors/suppliers.
7. All applicable taxes and shipping/delivery.
8. Credits and/or offsets
9. Mark-up for Overhead and Profit (in accordance with requirements in General Conditions)
10. Updated construction schedule to reflect the change(s) and the impacts on start and finish times, critical path, and float. Additional Contract time will not be granted unless no float is available and critical path is impacted.
11. If Change Order request is initiated by the Contractor, then include a description of the reasons and justification for the request.

1.3 CHANGE ORDERS FOR ALLOWANCES AND UNIT PRICE WORK

A. Administrative change orders will be issued to incorporate the actual cost of allowances and/or to reflect the actual quantities of unit price items incorporated into the Work. Refer to those specification sections for procedures and requirements.

1.4 CONSTRUCTION CHANGE DIRECTIVE AND TIME AND EXPENSE CHANGE ORDERS

A. When there is not enough time for the Contractor to develop a Change Order proposal or when the Owner and Contractor disagree on the terms of a Change Order proposal, the Engineer may issue a written directive instructing the Contractor to proceed with changes in the Work. These changes will be performed on a time and expense basis, and will be incorporated into the Contract at a later date with a written Change Order.

B. The Contractor is to promptly proceed with the changes in the work outlined in the Construction Change Directive. Should the Contractor disagree with the method provided for determining the proposed adjustments in the Contract Amount and/or Contract Time, he shall advise the Engineer of this disagreement. A Construction Change Directive signed by the Contractor indicates his agreement with the method for determining the proposed adjustments in the Contract Amount and/or Contract Time; however, the Contractor is to proceed with the work described in the Construction Change Directive regardless if the Contractor signs the Construction Change Directive or not.

C. The Contractor shall track and document the time and expense associated with the Work and shall maintain detailed records of the time and expense associated with the change(s).

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)
END OF SECTION 01 26 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. General coordination procedures.
   2. Requests for Information (RFIs).
   3. Project meetings.

1.4 GENERAL COORDINATION PROCEDURES

A. The Contractor shall coordinate construction operations with other contractors, the Owner, and other entities, to ensure efficient and orderly installation of each part of the Work.

B. The Contractor shall prepare and coordinate the following administrative items with other contractors, the Owner and the Engineer in order to ensure that the Work is completed in a smooth and orderly manner:

   1. Construction schedule.
   2. Schedule of values.
   3. Temporary facilities and controls.
   4. Submittals and coordination drawings.
   5. Progress meetings.
   6. Pre-installation meetings.
   7. Startup and commissioning
   8. Project closeout.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. The Contractor shall prepare and submit an RFI immediately upon discovery of the need for interpretation or additional information.

B. The Engineer will review and respond to each RFI within seven (7) days of receipt of the RFI. The Engineer's review may include a request for additional information, in which case the Engineer will respond within seven (7) days of receipt of the requested additional information.

C. The Engineer will not review or respond to requests for approval of submittals, requests for approval of substitutions, requests for approval of Contractor's means and methods or incomplete RFI's.

D. The Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.

E. If the Contractor believes that an RFI response warrants a Change Order, then the Contractor shall notify the Engineer in writing within ten (10) days of receipt of the RFI response. Requests for Change Orders shall be handled in accordance with the requirements in the Contract Documents.

F. RFI Log: The Contractor shall prepare and maintain an RFI log, and shall update it monthly for review at the progress meetings. The Engineer may also prepare and maintain a separate RFI log.

G. The Contractor shall notify the Engineer within seven (7) days if he/she disagrees with the response. Otherwise, the Contractor shall immediately distribute RFI responses to subcontractors, vendors and suppliers, as applicable.

1.6 PROJECT MEETINGS

A. Pre-Construction Meeting: The Engineer will schedule and conduct the pre-construction meeting, and will prepare and distribute meeting minutes.

1. Attendees: Attendees shall include the Contractor (project manager and superintendent, at a minimum), major subcontractors, the Owner, Engineer, and SRF representative (for SRF funded projects).
2. Agenda: The Engineer will prepare and distribute an agenda, which will include the following:

    a. Construction schedule and phasing (if applicable).
    b. Critical work sequencing and long-lead items.
    c. Substantial completion (if Contractor has questions regarding specific work items that are required to be complete before Owner accepts the project as being Substantially Complete.
    d. Key personnel and lines of communication.
    e. RFI procedures.
    f. Procedures for applications for payment.
    g. Submittal procedures.
    h. Use of the existing facilities and work restrictions/working hours.
    i. Temporary facilities and controls.
    j. Planned disruptions/shutdowns.
    k. Security.
    l. Progress cleaning.

B. Monthly Progress Meetings: The Contractor will schedule and conduct regular project progress meetings at the Project site unless otherwise indicated, and will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. The Contactor will coordinate the meeting dates and times with the Owner and Engineer. The Engineer will prepare and distribute meeting minutes.

1. Attendees shall include the Contractor (project manager and superintendent, at a minimum), major subcontractors, the Owner, and the Engineer.
2. Agenda: The agenda will typically include the following:
    a. Review and approve meeting minutes from previous meeting.
    b. Review of construction progress.
    c. Review of upcoming/planned construction activities.
    d. Status of RFI’s and Change Orders.
    e. Status of Submittals
    f. Review of potential weather impacts or other scheduling impacts/delays.
    g. Other pertinent items.

C. Pre-installation and/or Pre-startup Meetings: Conduct pre-installation and/or pre-startup meetings before each major construction activity and/or startup of equipment and new facilities. Attendees shall include, at a minimum, the key Contractor personnel, key subcontractor personnel, the installer and/or manufacturer's representative, Owner and Engineer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUBMITTAL REVIEW AND COORDINATION

A. Submittal Development and Contractor Review: Contractor shall develop and submit submittals as required to allow adequate time for review without delaying/affecting the schedule for the Work. No Contract extension will be allowed for submittal development and/or review/resubmittals. Contractor shall thoroughly review and familiarize himself with the existing facilities and shall obtain/incorporate all necessary field dimensions into the submittals prior to submitting and prior to beginning Work.

B. The Contractor shall be solely responsible for coordinating preparation and review/processing of the submittals with manufacturers and suppliers and for ensuring that they are developed and approved as required to complete the Work on schedule.

C. Time for submittal review shall begin upon receipt of complete submittal by Engineer. Contractor shall allow a minimum of 14 days for submittal review when no concurrent consultant review (e.g. electrical review) is required. Where concurrent consultant submittal review is required, allow an additional 7 days (total of 21 days).

D. Resubmittal Review: Allow 14 days for review of each resubmittal.

E. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received. No extension of Contract time will be granted for this.

F. Engineer will maintain a submittal log throughout the project.

1.2 ENGINEER'S DIGITAL CAD FILES

A. Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.

B. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

C. Digital Drawing Software Program: The Contract Drawings are available in Bentley Microstation (.dgn) or AutoCAD (.dwg) format.

D. Contractor shall execute a data licensing/use agreement provide by the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL SUBMITTAL REQUIREMENTS AND PROCEDURES

A. Contractor shall prepare and submit submittals in accordance with requirements in each Specification Section.

B. Electronic submittals (pdf format) are acceptable and can be submitted via email or other means.

C. Action Submittals (Requiring Review and Comments): Submit five (5) paper copies. Engineer will return two (2) copies unless Contractor indicates that it is for informational purposes only.

D. Submittals shall include the following information:

1. Project name, Owner Name and Date.
2. Name of Engineering Firm and name/contact information for Engineer.
3. Name, Addresses and Contact Information for Contractor, Subcontractor, Supplier and Manufacturer
4. Submittal number or other unique identifier, including revision identifier. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
5. Number and title of appropriate Specification Section.
6. Drawing number and detail references, as appropriate.
7. Location(s) where product is to be installed, as appropriate.
8. Other necessary identification.

E. During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall confirm the following:

1. The materials, products, and equipment being supplied are of the correct size, materials and type
2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
3. The products/equipment being supplied are intended for use in this application.

All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.

2.2 TYPES OF SUBMITTALS

A. Contractor's Construction Schedule: Prepare the construction schedule for review by the Engineer prior to the first progress meeting and prior to submitting an application for payment.

B. Schedule of Values – Prepare a schedule of values for review by the Engineer prior to submitting an application for payment.

C. List of Subcontractors and Major Equipment Suppliers: Prepare a written list of significant subcontractors and equipment suppliers to include name and contact information, and brief description of work and/or equipment being provided.

D. Application for Payment

E. Product Data: Develop and submit information as a single submittal for each component of the Work. Product data shall include the following:

1. Indicate which options are available and which ones are being furnished.
2. Manufacturer's catalog cuts, product specifications, and color charts.
3. Statement of compliance with specified referenced standards.
4. Testing data.
5. Delivery/availability/schedule information.
6. Availability and delivery time information.
7. Wiring diagrams.
8. Performance curves.
9. Other relevant information.

F. Shop Drawings: Shop drawings shall be developed/drawn to scale and shall include the following:

1. Name/Number/Identification.
2. Drawings shall be in sufficient detail to determine size and configuration.
3. Dimensions in plan and section/elevation, where applicable.
4. Requirements for coordination.
5. Signed and sealed, if required, by professional engineer.

G. Samples: Submit samples that are representative of the type, color, pattern and texture to be furnished/installed. Samples shall include the following:

1. Name/Number/Identification/Description
2. Product name, manufacturer name, and source of sample.

3. Location to be installed (include reference to specification numbers and/or drawings).
4. Samples for related components shall be submitted as a single package.

H. Welding Certificates: Prepare and submit welding certificates to certify that welding personnel are qualified and that welding was performed in accordance with all applicable standards.

I. Product/Material Certificates and Test Reports: Submit written reports on supplier/manufacturer letterhead to certify that products/materials and/or test reports comply with the Contract Documents and all other applicable codes/standards.
Field Test Reports.

PART 3 – EXECUTION

3.1 CONTRACTOR'S REVIEW

A. The Contractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. The Contractor shall note corrections and field dimensions, and shall include an approval stamp before submitting to Engineer.

B. The Contractor’s approval stamp shall include the following:

1. Project name and location.
2. Submittal number and specification title/number.
3. Name of reviewer and date of Contractor approval.
4. Statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S REVIEW

A. Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will either stamp each submittal with an action stamp and will mark stamp appropriately to indicate action or will provide an electronic stamp including comments pertaining to the submittal. Each submittal will be marked with one of the items below:

1. No Exceptions Taken: The Engineer has no comments to provide the Contractor. Contractor may proceed with current submittal acting as final submittal.
2. Make Corrections: The Contractor shall include any corrections provided by the Engineer and shall proceed with current submittal acting as final submittal.

3. Amend & Resubmit: Contractor shall make all necessary revisions as indicated by the Engineer and shall submit the corrected submittal to the Engineer for approval.
4. Rejected: Contractor shall resubmit based on the Engineer's comments.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary utilities, temporary support facilities, and temporary security.

1.2 USE CHARGES

A. The Contractor shall include all transfer and use charges and associated costs for temporary facilities (including setup, installation and removal) and permanent facilities in the Contract, unless specifically indicated otherwise.

B. Temporary Water and Sewer Service from Existing System: Water from Owner's existing water system is available for temporary use without metering and without payment of use charges until the (Final) Contract Completion date. Provide connections and extensions of services as required for construction operations.

C. Temporary Electric Power Service from Existing System: Electric power from Owner's existing system is available for temporary use without metering and without payment of use charges until the (Final) Contract Completion date. Provide connections and extensions of services as required for construction operations.

D. Initiate and schedule the transfer of temporary utility service to the Owner upon project completion. Costs associated with establishing all utility service in Owner’s name shall be borne by the Contractor.

1.5 QUALITY ASSURANCE

A. For all electric power service, Contractor shall comply with all applicable codes (NECA, NEMA, and UL standards and regulations, and NFPA).

B. Contractor shall obtain the required permits for all utilities.

C. Contractor shall comply with all applicable OSHA and ADA provisions for temporary ingress/egress.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with the Owner to locate the temporary facilities.

B. Isolate and protect Work areas and/or occupied facilities to prevent dust and fume entry.

C. Temporary Use of Facilities and Equipment: Any facilities or equipment that are used by the Contractor during construction shall be shall be made to be in “like new” condition with full manufacturer’s warranty prior to being turned over to the Owner. Items not meeting this requirement to the satisfaction of the Owner shall be deemed to be “used” and shall be replaced at the Contractor’s expense.

D. Provide temporary fire protection as necessary to protect against fire losses during construction.

E. Make provisions to protect materials and facilities from water damage and potential for creating mold, and keep interior spaces clean and dry. Control moisture and humidity if necessary.

F. Do not remove temporary facilities until they are no longer needed.

3.2 INSTALLATION OF TEMPORARY UTILITIES

A. Contractor is responsible for coordinating with Owner and/or utility providers for temporary utility installation.

B. Contractor shall provide temporary toilets, wash stations, and potable water for use of construction personnel.

C. Contractor shall provide temporary heating/cooling/dehumidification when required by construction activities for curing, drying, protection or for other reasons.

D. Provide temporary lighting as needed for construction operations, inspections and security.

END OF SECTION 01 50 00

SECTION 01 73 00 – EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Existing Conditions
2. Preparation and Construction layout.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.2 SUBMITTALS

A. Final Survey: Submit final property and/or topographic/planimetric site survey performed by licensed professional land surveyor. The Final Survey shall include all significant features, boundaries, benchmarks, contours, utility locations (valves, manholes, meters, etc.), and new piping inverts (storm water and sanitary sewer). The survey shall also include approximate limits of partially demolished/abandoned structures below grade.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: All materials used for cutting and patching shall be identical to in place materials. When identical materials are not available, new materials shall match existing (visually/aesthetically) as closely as possible, and shall be as durable in nature and as functional as existing materials.

PART 3 - EXECUTION

3.1 EXISTING CONDITION

A. The Contractor shall visit the site prior to bidding the Work and shall become familiar with the existing facilities, including sizes, locations, materials and other features of existing utilities/facilities. Prior to beginning work, the Contractor shall verify the location, sizes, and other features of existing utilities at connection points, crossing locations and/or other key locations. The existence and location of underground and

other utilities and construction indicated as existing are not guaranteed, so the Contractor shall fully investigate the existence, size, location and features (e.g. materials) as required to accurately price the Work prior to bidding the Work, and as required to execute the Work prior to orderings/installation.

B. Prior to bidding the Work, and prior to ordering materials and beginning Work, the Contractor shall examine all existing conditions (utilities, structures, finishes, etc.) and verify compatibility and suitability of materials, equipment and systems for all Work. Include all relevant information (including potential conflicts and/or issues such as compatibility, sizing) in a submittal(s) for review by the Engineer. Proceed with ordering and installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION AND CONSTRUCTION LAYOUT

A. The Contractor shall coordinate with the Owner and/or local utilities regarding the need to relocate existing utilities.

B. The Contractor shall be solely responsible for taking field measurements required to complete the Work, and shall incorporate the field measurements into submittals for review by Engineer prior to ordering materials and equipment and prior to beginning Work

C. The Contractor shall verify that no conflicts exist prior to ordering materials and equipment and prior to beginning Work. If conflicts and/or different field conditions are discovered, then the Contractor shall notify the Engineer immediately.

D. Construction Layout: The Contractor shall engage a land surveyor to verify and/or establish benchmarks, to verify layout information shown on the Drawings, and to lay out the Work. The Contractor shall check the location and correctness of the Work as it progresses.

3.3 INSTALLATION

A. The Contractor shall always confirm with manufacturer and shall follow manufacturer's written instructions and recommendations for installing products.

B. Bracing and Supports: The Contractor shall furnish and install all necessary anchors, fasteners, braces and supports required to securely anchor/support the Work. If size, quantity and/or type of anchor/support/brace is not shown, verify with manufacturer(s).

C. All components of the Work shall be installed plumb, straight, and level, and to maximize clearance(s) for access and/or maintenance. The Contractor shall also make provisions for thermal expansion and contraction.

3.4 CUTTING AND PATCHING

A. The Contractor shall employ skilled and experienced workers and shall do the following with respect to cutting and patching:

1. Patch the Work as quickly as possible after cutting.
2. Restore surfaces/cuts to their original condition or better.
3. Provide temporary bracing and supports.
4. Protect adjacent areas and/or other new construction.
5. Minimize interruption of existing utilities/facilities and coordinate with Owner prior to cutting/patching.
6. Patch in a manner that minimizes evidence of the Work.
7. Clean affected areas after cutting and patching is complete.

3.5 PROGRESS CLEANING

A. The Contractor shall maintain a clean project site and shall clean daily.

B. The Contractor shall not hold/accumulate waste(s) and shall dispose of waste in accordance with all applicable regulations/requirements. Waste materials shall not be buried or burned on site.

C. The Contractor shall clean and protect installed Work.

3.6 STARTING AND ADJUSTING

A. The Contractor shall coordinate startup and testing of equipment with the manufacturer, subcontractors, Engineer and the Owner.

B. The Contractor shall obtain manufacturer concurrence/approval of installation prior to startup. Malfunctioning/defective materials and equipment shall be replaced with new materials and equipment at no cost to the Owner.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. The Contractor shall protect and maintain the Work in new condition (without damage or degradation) until Final Completion. This includes maintaining cleanliness and avoiding staining of concrete walls and slabs due to construction activities. The Contractor shall be solely responsible for maintaining and/or cleaning to achieve a new finish, even if it requires resurfacing/recoating and/or replacing the affected Work.

3.8 CORRECTION OF THE WORK

A. The Contractor shall repair or remove and replace defective equipment, materials and/or construction at no cost to the Owner. All Work shall be restored and/or maintained in new condition until Final Completion.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. The following requirements must be met/completed before closing out the project:

1. Substantial Completion: The Contractor must have achieved written Substantial Completion in accordance with the requirements in the General Conditions.
2. Prepare and submit Project Record Documents.
3. Prepare and submit Operation and Maintenance Manuals.
4. Deliver tools, spare parts, extra materials, salvaged materials, etc. to Owner.
5. Completion of all equipment start-up and training.
6. Complete all punch list items.
7. Warranties: Obtain and submit specific equipment and product warranties. Overall project warranty and individual equipment/system warranties shall begin upon approval (date of Owner signature) of the Final Payment Application unless specifically stated otherwise.
8. The Contractor must satisfactorily address outstanding warranty items before Final Payment will be made.
9. Obtain and submit release permitting Owner unrestricted use of the Work and include occupancy permits/certificates, where applicable.
10. Removal of temporary facilities from Project site.
11. Notify Owner of insurance changeover/transfer requirements, where applicable.
12. Place any permanent utilities in Owner's name.
13. Final Cleaning: Employ experienced and skilled workers, or a professional cleaning service. Cleaning shall include the project site, grounds, buildings and all other facilities and areas affected by the construction. HVAC systems (including ducts) shall be inspected and cleaned and filters replaced.
14. Advertise for completion in accordance with the requirements in the General Conditions.
15. Written Consent of Surety: The Contractor shall have submitted written consent of Surety Company to final payment;
16. Affidavits: The Contractor shall have submitted affidavits (see General Conditions) and satisfactory evidence that there are no outstanding claims or demands against the Contractor in any manner connected with the work.
17. Submit a Final Application for Payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 77 00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field application of high-performance coating systems to items and surfaces scheduled.

1.2 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. SSPC - The Society for Protective Coatings.

C. NACE - National Association of Corrosion Engineers.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Specification Sections.

B. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.
9. VOC Content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.5 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F, and is expected to remain between 45 and 95 deg F for at least two hours after application.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.
3. All surface preparation and painting work is performed under the protective guidelines and requirements of OSHA "Safety and Health Regulations for Construction", latest revision, as set forth in the Federal Register, and that all such protection is the responsibility of the Contractor and shall be provided at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.

B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:

1. Induron Coatings, Inc. (Induron).
2. Tnemec Company, Inc. (Tnemec).

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate

colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

D. No claim of the Contractor concerning the unsuitability of the material specified or his inability to produce first class work with the same, will be entertained, unless such claim is made in writing to the Architect/Engineers before the Contract is signed.

2.3 COLORS

A. Colors: As selected by Owner from manufacturer's full range.

2.4 HIGH-PERFORMANCE COATING SYSTEMS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
6. Pre-Treatment Wash Primers: 420 g/L.
7. Floor Coatings: 100 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

D. General: Outline of coating work follows (with number of coats shown in parenthesis):

2.5 HIGH PERFORMANCE COATING SYSTEMS.

A. Ferrous Metals

B. Primed Interior Ductile Iron Pipe which is modified as a part of the project (6.0-10 mils DFT), applied by brush or roller:

Coating Type	Manufacturer and Coating	Number of Coats	Total DFT, mils
Prime	Induron PE 70 Epoxy Primer	1	3.0-5.0
	Tnemec Series 1	1	3.0-5.0
Intermediate	Induron Induramastic 85	1	4.0-6.0
	Tnemec Series 135 Chembuild	1	4.0-6.0
Finish	Indurane Indurathane 6600 Plus	1	2.0-4.0
	Tnemec Series 1094 Endura-Shield	1	2.0-4.0

2.6 COLOR COATING SCHEDULE

A. Color coding and identification of piping shall be in accordance with American National Standards Institute Standard ANSI A13.1-1975. The color schedule is preliminary, except for those items covered by ANSI A13.1-1975, and is subject to change by the Owner.

Water Piping Designations (Including Sample Piping)	Color
Raw Water	Utility Green
Settled Water	Aqua
Finished Water	Dark Blue
Wastewater	Pump Gray
Washwater	Azure Blue
Sludge	Brown
Fire Hydrants	Yellow
Potable Water	Safety Green
Hot Water, Potable	Safety Green w/ Red Band

B. Piping shall be labeled to indicate direction of flow.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall have on the project site the following testing equipment. Equipment shall be in calibration and proper working order. Equipment shall be used in accordance with the manufacturers' instructions or as directed by the Engineer. The Engineer shall be notified of time of testing so that he might be present to witness testing.

1. Sling Psychrometer: Relative humidity and dew point readings shall be taken at intervals throughout the days work. Readings shall be taken at the start of the mornings work, mid day and afternoon. Should environmental conditions change, additional reading shall be taken to assure that coatings are being applied under

the conditions as outlined by the coatings manufacturer.

2. Surface Temperature Thermometer: Surface temperatures shall be taken in areas where work is being performed. Surface temperature shall be that as specified by the coatings manufacturer.
3. Replica Tape & Micrometer Testex X-Course Replica Tape shall be employed to determine the surface profile of blasted surfaces. Surface profile shall be as specified.
4. Dry Film Thickness Measurements: Dry film thickness reading shall be taken with a properly calibrated (per the manufacturer's instructions) Type 1 (magnetic) or Type 2 (electromagnetic) instrument. Dry film thickness reading will be taken and recorded in the in a frequency and manner as dictated by the Engineer.

3.2 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
   a. Confirmation of primer's suitability for expected service conditions.
   b. Confirmation of primer's ability to be top coated with materials specified.

2. Notify Engineer/Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.3 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. All conduits, piping and other equipment which stub up through existing floors shall be removed to below the finished floor elevation (the existing flooring shall be chipped out as necessary to facilitate demolition). All existing piping shall be filled with approximately 3-inches non-shirk grout. The flooring shall then be patched as described within this specification.

C. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings.

1. Remove oil and grease before cleaning per SSPC-SP1 solvent cleaning.
2. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces or contaminate previously cleaned surfaces.
3. Sprinkle floors to lay the dust if necessary to prevent dust from falling on wet paint.

D. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Ferrous-Metal (Previously Painted):
   a. All surfaces shall be cleaned of all oil, grease, and other soluble contaminants in accordance with SSPC-SP 1 Solvent Cleaning.
   b. Clean all surface of chalk, loose paint, loose rust, as well as any other foreign matter in accordance with SSPC WJ 4 Light Cleaning.
   c. All areas of corrosion and failing existing coating shall be prepared in accordance with SSPC- SP 11 Power Tool Cleaning to Bare Metal. All edges shall be feathered. All surfaces shall be clean and dry.

E. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. All thinner shall be added to the paint upon activation. No thinner will be allowed to be added to activated paint to prevent hardening or curing of project prior to application.

3.4 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions, unless Architect/Engineer specifically authorize the contractor, in writing, to modify the procedure outlined in the manufacturer’s instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Provide finish coats compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

5. All paints and coatings shall be applied by qualified workmen, experienced in the application of particular type of paint or coating used.

a. Workmen shall exercise extreme care to protect all painted surfaces and/or those prepared for painting.
b. It shall be the Contractor's responsibility to prevent damage to any structures, vehicles, vegetation, etc., that might be affected by transmittal of solvent, or coating droplets, or mist, by wind or other means during the performance of the work outlined herein.
c. All workmanship shall be of the very best, with all materials evenly spread and smoothly flowed on without runs or sagging.

B. Finish paint coat shall not be applied to the structural parts of equipment, motors drives and similar items until such equipment has been erected, installed, tested and adjusted under service conditions.

C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration. Additional coats shall be required to achieve the specified Dry Film Thickness.

1. The number of coats and film thickness required is the same regardless of application method.

a. Omit primer on metal surfaces that have been shop primed and touch-up painted.
b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

D. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.

    a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    b. Brush out and work brush coats into surfaces in an even film.
    c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.

E. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

G. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.5 FIELD QUALITY CONTROL

A. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

B. Paints approved for various surfaces shall be as manufactured by companies listed above. The manufacturer shall make available to the Contractor the services of a technical representative who shall be consulted with respect to drying times, cure-out times, compatibility of primers and overcoats, and miscellaneous problems that might arise during the progress of the work.

C. The Contractor shall properly prepare surfaces prior to proceeding with work and shall be held responsible for any poor work caused by improperly prepared surfaces. The application of the first coat of paint by the Contractor shall be construed as an acceptance by him of the responsibility for the condition of the base.

D. After the new coatings have been in service for a period longer than six months, but less than twelve months, the Owner will make arrangements for an inspection of the

coatings, both interior and exterior.

1. The Contractor shall have a representative present for the inspection and shall be prepared to perform any minor corrective work at the time of inspection.

3.6 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.7 PROTECTION

A. The Contractor is solely responsible for protecting all existing surfaces, structures, and other facilities adjacent to or in the vicinity of the surfaces being coated, whether above or below ground. The Contractor must furnish, install and maintain all necessary protective measures in order to prevent overspray and/or other damage from occurring. The Contractor shall repair and/or pay for all damages resulting from his operations or personnel to existing facilities, and shall settle in full all damage suites which may arise as a result of his operations.

B. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces to original condition, or replace with new. Comply with procedures specified in PDCA P1.

END OF SECTION 09 96 00

SECTION 22 05 19 - FLOW METERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Venturi Tube Flow Meters

1.2 SUBMITTALS

A. Product Data: Provide product data for flow meters and performance characteristics for each flow meter.

B. Submit written confirmation that each manufacturer has reviewed all of the rate-of-flow controller requirements and that each piece of equipment is compatible with the other and that each piece of equipment is suitable for the intended design conditions.

C. Product Data: For each type of product indicated.

D. Shop Drawings: Include the following.

1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, stating system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
3. Power and control wiring diagrams, including terminals and numbers.
4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
5. Factory finish system.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Prepare all equipment for shipping as follows:

1. Protect internal and external parts against rust and corrosion.
2. Keep sealed and protected from moisture and store indoors.

1.4 WARRANTY

A. Warranty Period: One year from date of Substantial Completion. Warranty shall be for unlimited usage of the equipment for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Venturi Tubes

1. BIF
2. PFS

2.2 VENTURI TUBES

A. General:

1. The metering primary shall be the pressure differential producing type and sense true static pressure at the inlet and throat tap cross sections.
2. Inlet section shall be comprised of a cylindrical section, of the same nominal diameter as the pipe in which the high pressure tap is installed and shall help to isolate the high pressure sensation from pipe wall mismatch and condition the flow before it enters the throat section.
3. The throat section shall be cylindrical with a minimum length equal to 0.5 times its diameter. The low pressure tap shall be installed in this section. The outlet cone shall be truncated and have a maximum included angle of 10 degrees.
4. Interior and exterior surfaces, except the throat, shall be coated with a two part epoxy finish, NSF approved for use with potable water, dry film thickness (DFT) shall be at least 6.0 mils for both internal and external surfaces.
5. The differential pressure shall indicate static pressure change only. Devices such as “low-loss” flow tubes that employ entire or partial pitot effects and amplify the differential by changing flow direction at the point of sensing pressure, thus introducing unwanted hydraulic noise, are not acceptable.
6. The substantiated accuracy of the venturi meter shall be + or - 0.41% of actual rate for a pipe Reynolds number greater than 75,000. This accuracy shall be substantiated by a two times standard deviation calculation of at least thirty calibrated meter coefficients of different line sizes and beta ratios.
7. Provide inspection port(s) in the venturi tube.
8. Transmitter shall be mounted/installed below pipe centerline elevation.
9. The specified flow range shall be 0.5 to 1.0 MGD per filter.

B. Materials of Construction:

1. The body of the venturi meter shall be of cast iron, ASTM A-126, Grade.
2. The throat section and tap bushings shall be fully 316 stainless steel. The throat wall thickness shall be at least 1.0".
3. The meter shall have ANSI Class 150 cast iron flanged ends.
4. The controller shall be hydrostatically tested using blind flanges, thus loading the unit in tension to a pressure of 250 PSIG. The results of this test must be certified. At the option of the Engineer, the manufacturer shall provide mill certificates and weld radiographs.

2.3 RATE OF FLOW CONTROLLERS

A. Rate-of-flow controllers shall generally consist of a flow meter, modulating valve, actuator, DP transmitter and appurtenances. Contractor shall coordinate venturi tube

requirements with those of modulating valves and actuators for rate-of-flow applications.

B. Contractor shall ensure that all equipment is compatible and suited for the specific application regardless of whether it is furnished from a single manufacturer or multiple manufacturers.

C. Specifically, Contractor shall confirm the following with manufacturers:

1. The valves will not search within the specified flow range.
2. The valves will hold their set point within the specified flow range
3. There will be no interference or physical conflicts (such as between the disc and the recovery cone) between the valves and the flow meters/tubes or other appurtenances.

D. Rate-of-flow controllers which develop hunting characteristics, fail to hold their set point, or create negative throat pressure conditions within the range of required operation will not be acceptable. They must be replaced with properly operating systems at the full expenses of the contractor, parts and labor included.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment and installation area for compliance with requirements for installation tolerances and other conditions affecting performance

B. Examine controller for cleanliness, freedom from foreign matter, and corrosion.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer’s detailed written instructions for installing equipment.

B. Performance Test:

1. The Contractor and manufacturer shall conduct a performance test on each installed flow meter.
2. The performance test shall determine the flowrate through the meter as a function of the flow control valve position over the range 10 percent open to 100 percent open in 5-degree increments.
3. The data shall be presented in a table and graph for each test and submitted to the Owner.

3.3 CLEANING AND PROTECTING

A. Restore marred, abraded surfaces to their original condition.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, and ensure that equipment is without damage or deterioration at the time of Substantial Completion.

3.4 START-UP ASSISTANCE AND TRAINING

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. A factory authorized service representative (for each system and/or piece of equipment) from the manufacturer shall perform all necessary on-site assistance and installation supervision.
2. Once the flow meters and/or rate-of-flow controllers have been installed correctly and are operating as intended, the service representative(s) shall perform eight (8) hours of on-site start-up assistance/operator training.
3. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventive maintenance.
4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 22 05 19

SECTION 22 05 23 - VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Butterfly Valves

1.2 SUBMITTALS

A. Product Data:

1. For each type of valve indicated include the following information:

a. Body, seating, and trim materials
b. Valve design
c. Pressure and temperature classifications
d. End connections
e. Arrangement
f. Dimensions
g. Required clearances

2. Include list indicating valve and its application.
3. Include rated capacities.
4. Include shipping, installed, and operating weights.
5. Include list of furnished specialties and accessories.
6. Include proof of hydrostatic test and proof of design test.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturer's: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Butterfly Valves

a. Pratt
b. DeZurik
c. American by Val-Matic

2.2 BUTTERFLY VALVES

A. Butterfly valves shall be designed, manufactured and tested in accordance with the provisions and requirements of ANSI/AWWA C504, Class 150B latest revision.

B. Valve bodies shall be constructed of cast (gray) iron ASTM A126-73 Class B, ductile iron ANSI/ASTM A536 Grade 65-45-12, or alloy cast iron ANSI-ASTM A436 Type 1 or 2, or ANSI/ASTM A439 Type D2.

C. Valve discs shall be solid construction, and shall be alloy cast iron ANSI/ASTM A436 Type 2.

1. Edges of discs for valves with rubber seats in the body shall be shaped, machined and polished to such configuration as will ensure smooth and even mating with the rubber seat over an acceptable angle of interference (±2½°).
2. The disc shall rotate 90° from full open position to tightly closed position, and shall be of such design as to sustain maximum differential pressure across the closed disc without exceeding a working stress of one fifth of the tensile strength of the material used in the manufacture of the disc.

D. Valve seats shall be designed so as to provide tight shut-off (droptight) at the
E. maximum pressure differentials resulting from the working pressures specified.

1. Seating materials shall be new natural rubber or new synthetic rubber conforming to the requirements of ANSI/AWWA C504, latest revision.
2. Rubber seats shall be bonded or mechanically fastened in the valve body or disc.

F. All clamps, retaining rings and fasteners shall be stainless steel specified in the above referenced AWWA Standards.

G. Valve shafting shall be stainless steel in accordance with AWWA C504, and may be either one-piece through-body-and-disc construction, or may be stub-shaft construction.

1. Each stub-shaft shall be inserted into hubs integral with the valve disc for a distance of at least 1½ times the diameter of the shaft.
2. Lengths of hubs extending from the disc shall be such that the full required insertion can be attained.
3. The connection between the shaft and the disc shall be designed to transmit shaft torque equivalent to at least 75% of the torsional strength of the minimum shaft diameters.
4. Dowel and taper pins, if used, shall be mechanically secured.

5. All penetrations in the shaft shall be compensated for by increase in shaft diameter so that the relationship of transmitted torque to shaft torsional strength will be maintained.

H. Valve bearings shall be sleeve type, non-corrosive, and of "self-lubricated" materials. Thrust rings and/or bearings shall maintain the disc in designed centered position. Valve shafts shall be designed for connections to operators as required, and shaft seals shall be provided at capped ends and projecting ends.

I. Two external hubs for housing shaft bearings shall be integrally cast with valve bodies, and the bodies shall be equipped with mechanical joint ends, flanged ends or Victaulic ends as required.

J. All valves shall be droptight when subjected to the specified working pressure (differential pressure), and all valves shall be capable of droptight seating under bidirectional flow conditions (maximum working pressure applied as differential pressure from either direction).

K. All valve components shall be capable of withstanding water hammer shock equal to not less than 150% of pressure rating. Although the valve may leak under water hammer shock condition, after the shock has passed the valve shall return to droptight functioning without the need for any adjustment.

L. Finishes:

1. All internal ferrous metal surfaces of the valve shall have a factory applied 2-part thermo setting epoxy coating in conformance with AWWA C-550-81, or latest revision. The epoxy coating shall be FDA approved, non-toxic, taste and odor free. Surfaces shall be painted in accordance with the following Schedule:

Interior Unfinished Surfaces	Epoxy
Exterior Surfaces of all other valves	Rust-inhibitive primer
Polished or Machined Surfaces	Rust-preventive compound

2. Interior coatings shall comply with AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Epoxy	10 mils
Rust-Inhibitive Primer	3 mils

M. Valve Operators:

1. Valve Operators shall be traveling-nut type or geared type designed to withstand 300 ft. lbs. of input torque at fully open or fully closed positions without damage to valve or operator.
2. Operator case shall be fully-enclosed type to prevent entrance of dirt or moisture, and the case shall be grease-packed.

3. Stop-limiting devices shall be provided in the operators for open and closed positions.
4. For exposed valves, the travel of the valve shall be indicated on quadrant bolted to the body.

N. All valves shall open "left".

O. All valves shall be cycled at the factory as required by the AWWA Standard. After the valves have been received on the job, and immediately before they are to be installed, they shall be cycled not less than five times to determine whether proper closure will be obtained. Any adjustment required to secure proper closure shall be performed by a qualified representative of the manufacturer of the valve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. General

1. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
3. Locate valves for easy access and provide separate support where necessary.
4. Install valves in horizontal piping with stem at or above center of pipe.
5. Install valves in position to allow full stem movement.

B. Butterfly Valves

1. Valves installed underground shall be equipped with grease packed operators having gasketted covers to prevent entrance of moisture into case when subjected to external hydrostatic pressure of 10 psi.
2. Valves shall be operated through AWWA valve nut mounted on vertical operating shaft extending through top of gear case. Operator extension, valve box, position indicator, and cover shall be provided for each valve. Extensions and valve boxes shall be of correct length and height to suit elevation of ground surface.
3. Valves installed in locations accessible from floor or ground shall be equipped with handwheels.
4. Valves installed in locations higher than 6'-6" above finished floor or ground shall be equipped with chainwheels and chain. The last stated provisions shall apply except when valves are indicated to be operated through floorstands or benchstands located above the valves, and in such cases valves shall be equipped with enclosed operators, extension stems, floorstands (or benchstands), and indicators.
5. The valves shall be furnished complete in accordance with the requirements of Section 5 of ANSI/AWWA C504.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 05 23

SECTION 22 05 23.10 - VALVE AND GATE ACTUATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of actuators:

1. Electric Actuators (Valves and Gates)

1.2 SUBMITTALS

A. Product Data: Provide product data for each type of actuator to be provided. Provide a schedule of actuators that lists each actuator and the corresponding valve or gate. The schedule should indicate the type, size, opening and closing speeds, description of use and/or location, sizing calculations, and other useful information for each actuator and valve or gate. A detailed list of accessories should also be provided for each actuator.

B. Electrical and SCADA system requirements

1.3 DELIVERY, STORAGE, AND HANDLING

A. Prepare actuators for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Seal and secure actuators to protect from dust, moisture and damage during shipping.

B. Use the following precautions during storage:

1. Keep actuators sealed and protected from moisture.

2. Store actuators indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in a dry location.

1.4 WARRANTY

A. Actuators shall be warranted for a period of twelve (12) months from Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Auma
2. Rotork
3. EIM

2.2 ELECTRIC ACTUATORS (VALVES AND GATES)

A. Actuators shall be rated for modulating service with a filter rate-of-flow controller. Acutator shall be supplied by venturi tube manufacturer as a complete package.

B. The valve operators shall include, but shall not be limited to, the declutch lever, handwheel, motor, gearing, limit switches, torque switches, and electrical control connections shall be of the top mounted configuration. Where specified, or noted on the plans, the electric actuators shall be Factory Mutual approved Explosion Proof protection Class I, Division 1, Groups B, C and D for hazardous locations.

C. Declutching mechanism shall allow valve operation by means of permanently attached auxiliary handwheel, meeting the O.S.H.A. requirement of no more than fifty pounds (50) rim pull effort. Actuation of motor automatically returns the operator to the electric mode. Operation of the motor shall not cause the handwheel to rotate, and operation of the handwheel shall not cause the motor to rotate. Should power be returned to the motor while the handwheel is in use, the design of the unit shall prevent transmission of the motor torque to the handwheel. The handwheel shall have an arrow and the word "OPEN" indicating required rotation. The handwheel shall operate in the clockwise direction to close. External declutch lever will be padlockable in the motor mode. Actuators for sluice gates and/or gate valves larger than 48" in diameter shall be provided with an operating nut attached to the manual override drive mechanism that allows operation of the actuator in the manual mode by a powered drill or wrench operating at no more than 100 RPM.

D. All motors, gearing switches, wiring terminals and electrical connections shall be completely sealed against the environment and protected against the ingress of water, humidity, and dust. Enclosure shall be rated NEMA 4X/6. No exposed wiring or terminals shall be allowed in the switch compartment. Switches (limit and torque) shall be in IP 66 enclosure such that no dirt, dust water, etc. may interfere with the contact when limit switch compartment is removed. Actuators shall be supplied with a watertight seal between external wiring connection and the actuator housing. This seal shall prevent water ingress due to moisture penetration into conduit or external wiring connections.

E. Actuators intended for submerged applications shall be tested to IP68 standard and shall be capable of submersion to 20 feet for a period not to exceed seventy-two (72) hours.

F. Drive motor shall be designed for 460V/3PH/60Hz supply voltage and shall be of sufficient size to open or close valve against maximum differential pressure when voltage to the motor terminals is 90 percent of the nameplate rating, without loss motion considered. The motor shall be specifically designed for actuator service. Motor shall be of the squirrel cage induction type and shall be totally enclosed, non-ventilated construction. Insulation shall be Class F, tropicalized and suitable for temperatures of up to 310 degrees F. Motor shall be of the “thermally protected” type, with three (3) thermal switches imbedded in motor windings one hundred twenty (120) degrees apart. Motor nameplate shall be in accordance with NEMA standard MGI. Motors for modulating service shall be capable of a minimum of 1,200 starts per hour.

G. All gears must meet A.G.M.A. specifications. Gearbox is to be 100% lubricant filled. To assure zero leakage, each gearbox is to be pressure tested while submerged and a visual inspection made of all seals before lubricant is installed. Gear housing shall be ductile iron or cast iron. Spur gear and worm shall be steel. Worm gear shall be bronze. Nonmetallic gears in power train are not acceptable. All gears and shafting shall be supported on anti-friction bearings. All gearing and bearings shall be grease or oil lubricated. Seals shall be provided at all exit points of the gear case to prevent leakage of lubricant.

H. Actuators with auxiliary gearing require that auxiliary gearing shall be of the wormgear type. All wormgears shall have 360 degree gearing. Gear segments are not acceptable. Mechanical stops must be adjustable from 80 to 120 degree rotation.

I. Operator is to have separate drive nut assembly with thrust bearing assembly mounted so operator may be easily mounted and removed without having to unload the valve stem, and also allow operation of the valve without operator in emergency situations. For quarterturn applications, valve stem to gearbox mounting shall be through splined coupling of not less than 32 teeth. For multi-turn applications, attachment to the valve shall be via a mounting flange together with bronze stem nut and thrust bearings to form one (1) assembly, which is bolted to the actuator. The design of the drive system shall be such that the actuator shall be capable of removal from the valve, retaining the output drive assembly and stem nut on the valve. Emergency operation of the valve must be possible with the actuator removed.

J. Limit switches with a minimum of twelve (12) contacts rated 5A to 250VAC shall be provided for each operator (3 N.O & 3 N.C for opening and 3 N.O. & 3 N.C for closing, one pair of which shall be dry contacts available for remote voltage interrogation). Limit switch drive to be of counter gear design and shall be “in step” with the output drive at all times in both the motor drive and manual (handwheel) modes. Limit switches shall be adjustable to change state at any point between or beyond the fully open and fully closed positions, with easy set declutch. All contacts on the limit switch assembly to be sealed in minimum IP 66 enclosure to maintain the integrity of the contacts and to eliminate shorting out. Indicating lamp circuitry shall include motion assurance to indicate when the operator is in motion, and direction in which it is traveling. Motion assurance shall be wired into lamps on operator, and available for remote light circuits when specified. Position indication shall be accomplished by means of an indicator dial in full step at all times with valve travel, whether in power or manual operation. The indicator dial shall be graduated in 25% increments (closed, 25% open, 50% open, 75% open and 100% open). Limit switch gearing shall be grease lubricated. The drive mechanism shall be totally enclosed to prevent entrance of foreign matter. Metallic gears shall be used.

K. Each operator shall have a separately adjustable opening torque switch and closing torque switch. Adjustment range shall be responsive to opening or closing loads such that switches operate to protect valve and operator from damage when there is over-torque during opening or closing. All contacts shall be sealed to insure the integrity of the contacts and to eliminate shorting out. When required, opening torque switch shall be able to control predetermined back seating thrust of a valve. Closing torque switch shall control predetermined seating thrust required for torque seating of wedge gate or globe valves. Seating torque shall be constant and independent of wear in valve disc or seat. Torque switches shall be of the SPDT, double break type with contacts rated 5A at 250VAC.

L. The actuator electrical junction box (terminal compartment) is to be completely isolated from the switch compartment and shall include the terminals for the motor leads up to 15 h.p. No separate junction box or external conduit shall be needed for the motor. Bolts shall be “captive” to prevent loss when disconnected.

M. The actuators shall be supplied with integral control housings that include reversing motor contactors, electrically and mechanically interlocked, equipped with auxiliary contacts. Contactor shall be completely wired to the complete electrical control assembly shall be contained in a minimum NEMA 4X/6 rated housing integral to the operator. Control power transformer shall be grounded with fused secondary and capable of transforming 460V, 3phase, 60 Hz to 24V DC. A minimum of three (3) threaded hubs for electrical conduit entry in controller compartment shall be provided, one (1) for primary power and two (2) for control circuits. All internal wiring in the housing shall be to terminal strips or plug assembly and all switches shall be wired to these terminals. Open-stop-close controls shall be by means of a three (3) push buttons and two (2) lights, Green for Open, Red for Closed. Local-Off-Remote control shall be by means of a three (3) position selector switch, padlockable in three positions. Auxiliary contacts shall be provided on the Local-Off-Remote selector switch to facilitate remote indication of switch position. Padlocks shall be provided for each actuator and shall be common keyed with all actuators. Actuator control packages shall be easily wall mountable remote from the actuator if required on plans. Controls packages shall be supplied with internal phase discriminator, monitor relay for collective fault signal and surge protection to 10 KV exceeding IEEE 587. An internal phase correction device shall be provided to prevent incorrect phase rotation of three phase actuators.

N. Modulating valves and gates shall meet the above requirements, and shall include solid state starters. The position comparator circuit shall be of solid state printed circuit board design and shall include (but not be limited to) separate controls for a zero span and deadband adjustment. LED lamps shall be furnished for indication of control status and shall include as a minimum, indications for open, close and fault. One (1) watt mylar potentiometers shall be used and shall be capable of providing linearity of +/- 1% and shall be rated for up to 250 degrees F. Internal power supply shall provide regulated 24VDC power to power solid state comparator circuit (positioner) and shall have the capability to supply power to an internal, solid state 4-20 mA feedback device.

O. Actuated quarter turn valves 12” and smaller shall move from the fully open to fully closed position in 30 seconds; actuated valves larger than 14” and all valves for modulating service shall move from the fully open to fully closed position in no less than 60 seconds. Gates or valves of all sizes shall move from fully open to fully closed at a rate equal to or greater than 60 seconds per 12” of gate or valve travel.

P. If actuator floor stands are to be provided, then they shall be constructed of carbon steel or cast ductile iron sufficient to withstand the loads required to operate the actuated valve and shall be painted in accordance with the specifications. Floor stands shall be provided with permanently sealed and lubricated shaft bearing at the base of each floor stand.

Q. The Contractor shall coordinate, furnish, and install all conduit, wiring, contacts and appurtenances necessary for incorporating the equipment into the SCADA system as shown and/or specified in the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine actuators for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine actuators for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent gate movement during shipping and handling.

C. Do not attempt to repair defective actuators; replace with new actuators.

3.2 ACTUATOR INSTALLATION

A. General

1. Drawings indicate general arrangement of gates and/or actuators.
2. Comply with manufacturer's detailed written instructions for installing equipment.
3. Electrical Connections: Rough-in electrical connections according to requirements in Division 26.

3.3 CLEANING AND PROTECTING

A. Restore marred, abraded surfaces to their original condition.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure equipment is without damage or deterioration at the time of Substantial Completion.

3.4 START-UP ASSISTANCE AND TRAINING

A. A factory authorized service representative of the actuator manufacturer shall perform all necessary on-site assistance for actuator installation supervision and pre-startup wiring verification, and shall perform eight (8) hours of on-site start-up assistance/operator training once the equipment has been installed correctly and is operating as intended.

END OF SECTION 22 05 23.10

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. 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

1.2. 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 distribution system as shown on drawings and/or specified herein.

D. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.

E. Install and connect electrical equipment mentioned in Division 26/27/28 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.

F. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.

G. Furnish and install complete controls, instrumentation & auxiliary systems as shown on drawings and/or specified herein.

H. Furnish and install complete telephone/data raceway (including all outlet boxes, face plates, conduit raceways, telephone backboards, terminal cabinets, etc.) system as shown on drawings and/or specified herein.

I. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.

J. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.

K. 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.

L. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

PART 2 - PRODUCTS

2.1. 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 26/27/28 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.

2.2. 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 26 24 17: LIGHTING PANELBOARDS
   2. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
   3. 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 26/27/28 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

3.1. 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.

3.2. 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.

3.3. 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.

3.4. 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.

3.5. 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.

3.6. 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-storted equipment as directed by Engineer.

3.7. 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.

3.8. 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 26/27/28 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.

3.9. 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.

3.10. 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.

3.11. 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.

3.12. 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).

3.13. 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.

3.14. 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.

3.15. 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 26 05 53 for additional requirements.

3.16. GROUNDING

A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.17. TELEPHONE WORK

A. Provide telephone raceways, outlets and backboards, as shown. Provide additional work as shown on drawings. Bond all raceways together at backboards and provide No. 6 ground wire extending from raceway bonds to cold water pipe, in 1/2 inch raceway. Carefully ream ends of all raceways.

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.

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 26 05 00

SECTION 26 05 19 - POWER CONDUCTORS AND CABLES 51V-600V

PART 1 - GENERAL

1.1. DESCRIPTION

A. Power Wires and Cables

B. Low Voltage Wires and Cables

PART 2 - PRODUCTS

2.1. 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. 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.

D. 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.

2.2. 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

3.1. 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.

3.2. 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.

3.3. 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.

3.4. SHIELDED CABLE INSTALLATION

A. 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.

3.5. 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. 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.

3.6. 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.

3.7. LABELING AND COLOR CODING OF WIRE AND CABLE

A. Refer to Specification Section 26 05 53 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.

3.8. 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 26 05 19

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1. 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.

1.2. 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

2.1. 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.

2.2. 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).

2.3. 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

3.1. 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.

3.2. 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.

3.3. ACCEPTANCE DOCUMENTATION AND TESTING

A. 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.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1. 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

2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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

3.1. 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.

3.2. 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 shall be sealed (at the first box or outlet) with polyurethane grout compound that expands to form a flexible foam seal that prevents the entrance of gases or liquids from one area to another (Prime Resins Prime-Flex or equal).
6. 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.
7. 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).
8. 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.

END OF SECTION 26 05 33

SECTION 26 05 34 - OUTLET BOXES, JUNCTION BOXES, WIREWAYS

PART 1 - GENERAL

1.1. DESCRIPTION

A. Outlet and Junction Boxes

B. Pull Boxes

C. Wireways

PART 2 - PRODUCTS

2.1. 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.

2.2. 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.

PART 3 - EXECUTION

3.1. 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. All boxes installed exposed in exterior or wet areas shall be stainless steel (NEMA 4X).
   2. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
   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. 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.
   5. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
   6. All others shall be oil tight JIC box not less than 16 gauge.

3.2. 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 26 05 53 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 26 05 34

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1. 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

2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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

3.1. 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.

3.2. 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 26 05 19 for all color-coding requirements of wires and cables.

3.3. 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.

3.4. 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”.

3.5. 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.

3.6. 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.

3.7. 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 26 05 53

SECTION 26 24 17 - LIGHTING PANELBOARDS

PART 1 - GENERAL

1.1. GENERAL

A. The work under this section includes but is not limited to the following:
   1. Lighting Panelboards
   2. Circuit Breakers

PART 2 - PRODUCT

2.1. 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.

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).

2.2. 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.

2.3. 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.

2.4. MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D' or Cutler Hammer.

PART 3 - EXECUTION

3.1. 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.

3.2. PANEL IDENTIFICATION

A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 17

SECTION 27 05 00 - AUXILIARY SYSTEM CABLES, 0-50V

PART 1 - GENERAL

1.1. DESCRIPTION

A. Cables rated for 0V-50V application

PART 2 - PRODUCTS

2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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

3.1. 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.

3.2. 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.

3.3. LABELING

A. Refer to Specification Section 26 05 53 for all labeling requirements.

END OF SECTION 27 05 00

APPENDIX A

Electric Machine Control, Inc.
7015 Haisten Drive
Trussville, Alabama 35173
Phone: 205-661-3998
Fax: 205-661-3997
http://www.emcinc.biz

TOTAL PAGES IN THIS QUOTE: **2**

Proposal

Company:	City of Northport	From:	Brian Thomason	
	c/o Krebs Engineering, Inc.	email:	jdenton@emcinc.biz	
	2100 River Haven Drive, Suite 100	Phone #:	205-612-0723	
	Birmingham, AL. 35244	Date:	3/16/2023	Revised
Attention:	Jason Dearing			
Phone #:	205-987-7411	EMC, Inc., Prop. #	EM210209R3VU	R3 Value Engineering
email:	jason.dearing@krebseng.com	Customer Ref. No.	V. Jason Dearing	

Qty.	Description	Price Each	Total Net
	City of Northport **Water Treatment Plant** **SCADA, PLC, and Network Modernization for PID CONTROL ONLY**		
	March 23 Updated Pricing		
1	Existing SCADA Server Hardware Move from Northport Admin Services Building (Cynthia's Office) Includes: Computer, Monitors, and Battery Back-Up.	$ 306.00	$ 306.00
1	Move Administration Router to Water Plant	$ 306.00	$ 306.00
1	Central Terminal Unit (Now Mounted in Annunciator Cabinet) Allen Bradley Components – Basic Unmanaged Network Switch, ControlLogix PLC with Required Rack, Programming (Note:Removed EtherNet/IP to Modbus Serial Gateway, Flex I/O for Annunciator Panel) General Components - Basic Uninterruptable Power Supply, DC Power Supply, and Required Circuit Breakers, Relays, Terminal Blocks, Etc. Assembly of the Above.	$ 38,088.15	$ 38,088.15
6	Sand Filter Consoles Allen Bradley Components – Network Switch, Flex I/O for Sand Filter Consoles with Required Parts. General Components - Uninterruptable Power Supply, Filter Fan Unit, DC Power Supply, and Required Circuit Breakers, Relays, Terminal Blocks, Etc.	$ 12,485.06	$ 74,910.36
1	In Field Start-up, Configuration, and Testing	$ 25,245.00	$ 25,245.00
1	Travel and Living Expenses	$ 5,711.00	$ 5,711.00
1	Less Parts Previusoly Ordered for Long Lead Items	$ (28,958.00)	$ (28,958.00)
	Total		**$ 115,608.51**

Comments:
This is ONLY BASIC Requirements for PID Sand Filter Valve Control.
This is a good faith estimate to establish an allowance. This estimate is a value engineered. Not Recommended from a risk,

Electric Machine Control, Inc.
7015 Haisten Drive
Trussville, Alabama 35173
Phone: 205-661-3998
Fax: 205-661-3997
http://www.emcinc.biz

TOTAL PAGES IN THIS QUOTE: 2

Proposal

Company:	City of Northport	From:	Brian Thomason	
	c/o Krebs Engineering, Inc.	email:	jdenton@emcinc.biz	
	2100 River Haven Drive, Suite 100	Phone #:	205-612-0723	
	Birmingham, AL. 35244	Date:	3/16/2023	Revised
Attention:	Jason Dearing			
Phone #:	205-987-7411	EMC, Inc., Prop. #	EM210209R3VU	R3 Value Engineering
email:	jason.dearing@krebseng.com	Customer Ref. No.	V. Jason Dearing	

resiliency, control, and data collection stand point.
All exterior wire and conduit responsibilities of others. Home run Ethernet cable from Annunciator Cabinet to each Sand Filter responsibility of others.

	Ship Date ---------- WILL BE COMFRIMED AT TIME OF ORDER			
	Terms ---------- Progress Billing. Net 30 Days			
	FOB ---------- Shipping Point			
	Freight ---------- Allowed			

The "Conditions of Sale" and "Terms and Conditions" of Electric Machine Control, Inc. Apply to this Quotation.

This Proposal is Valid for 30 Days.

x

APPENDIX B

SUBMITTAL

PRESENTED TO:

Eco-Tech Inc.
PO Box 956
Holly Springs, GA 30142
US

PERTAINING TO:

Purchase Order Number:
22094AL-45

Project Reference:
Northport WTP (AL) Filters 1-2-3

PRODUCTS/SERVICES:

Quantity	PFS Model No.	Serial No.	Tag No.:
3	8" C HVT-FCC	24489-01-01 to -03	Filter 1, Filter 2, Filter 3

Certified By: Brian Lesniak
Primary Flow Signal, Inc.

Revision	Date
0	8/10/2022

PFS Quote #: Q925-21
Submittals: (1) EMAIL

PRIMARY FLOW SIGNAL, INC. HEREBY PROVIDES THIS SUBMITTAL FOR APPROVAL. WRITTEN APPROVAL, INDICATED AS FOLLOWS, MUST BE RECEIVED IN ORDER TO RELEASE THE ORDER TO MANUFACTURE

☐ ***Approved As Submitted***

Signature, Title *Company Name, Date*

☐ ***Approved As Noted***
(Provide PFS with copy of all notations)

Signature, Title *Company Name, Date*

PLEASE RETURN A COMPLETE SIGNED COPY OF SUBMITTAL TO PFS AT YOUR EARLIEST OPPORTUNITY.

Primary Flow Signal

Primary Flow Signal, Inc.
800 Wellington Ave.
Cranston, RI USA 02910
Ph: (877) 737-3569
Fax: (401) 461-4450

NSAI

Certificate of Registration of Quality Management System to ISO 9001:2015

The National Standards Authority of Ireland Inc. certifies that:

Primary Flow Signal, Inc.
800 Wellington Avenue
Cranston, RI 02910
USA

has been assessed and deemed to comply with the requirements of the above standard in respect of the scope of operations given below:

The Design and Manufacturing of Flow Measuring Equipment

Geraldine Larkin
Chief Executive Officer

Lisa Greenleaf
Operations Manager

Registration Number: 19.3458
Certification Granted: April 04, 2002
Effective Date: May 22, 2021
Expiry Date: May 21, 2024

ANAB ANSI National Accreditation Board ACCREDITED MANAGEMENT SYSTEMS CERTIFICATION BODY

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

National Standards Authority of Ireland Inc., 20 Trafalgar Square, Nashua, New Hampshire, NH 03063, USA T +1 603 882 4412

REVISION STATUS

PFS Job #: 24489
Quote No.: Q925-21
Customer: Eco-Tech Inc.
Project Name: Northport WTP (AL) Filters 1-2-3

DOCUMENT	REV.	DATE
SUBMITTAL	0	8/10/2022

Engineer: BL Date: 8/10/2022

Primary Flow Signal

Primary Flow Signal, Inc.
800 Wellington Ave.
Cranston, RI USA 02910
Ph: (877) 737-3569
Fax: (401) 461-4450

PRIMARY FLOW SIGNAL
800 WELLINGTON AVENUE
CRANSTON, RI 02910

PH 401-461-6366
FAX 401-461-4450
www.primaryflowsignal.com

PROJECT CONTACT INFORMATION

CUSTOMER	**Eco-Tech Inc.**
PO NUMBER	**22094AL-45**
PFS SO NUMBER	**24489**
PFS QUOTE NUMBER	**Q925-21**

NAME	*POSITION*	*PHONE*	*email*	*Commercial Contract*	*Purchase Order*	*Engineering PM Manage*	*Document Control*	*Traffic Shipping*	*Expediting*	*Accounts Receivable*
Dean Soderberg	***Sales***	877-737-3569	dsoderberg@primaryflowsignal.com	TO	TO	Copy	Copy	Copy	Copy	Copy
Brian Lesniak	***Product/Project Engineer***	877-737-3569	blesniak@primaryflowsignal.com			TO	TO		Copy	
Mike Choquette	***Expediting***	877-737-3569	mchoquette@primaryflowsignal.com					Copy	TO	
Joel Dwyer	***Engineering Manager***	877-737-3569	jdwyer@primaryflowsignal.com			Copy	Copy		Copy	
Cindy DeJesus	***Commercial Contract Document Control***	877-737-3569	cindy@primaryflowsignal.com	Copy	Copy	Copy	TO			
Mike Choquette	***Traffic Shipping***	877-737-3569	logistics@primaryflowsignal.com					TO	Copy	
Marcia Neu	***Accounts Receivable***	877-737-3569	mneu@primaryflowsignal.com							TO

World Headquarters
800 Wellington Avenue
Cranston, RI USA 02910
Ph: 401-461-6366
Fax: 401 461-4450

Primary Flow Signal

Industrial Products Division
7136 S.Yale Avenue
Tulsa, OK USA 74136
Ph: 918-481-3210
Fax: 918-481-3205

PRIMARY ELEMENT SIZING CALCULATION
LIQUID – VOLUMETRIC FLOW

Version:4.2

By BL

Customer Information

Customer:	Eco-Tech Inc.	Date:	8/10/2022
Address:	PO Box 956	Project Name:	Northport WTP (AL) Filters 1-2-3
	Holly Springs GA 30142 U.S.A.	PFS Quote No.:	Q925-21
		Tag No.:	
		Customer PO No.:	22094AL-45
Contact Name:		PFS Serial No:	24489-01
Telephone:		Engineer:	
Fax No.:			
Email Address:			

Primary Flow Element

Model:	8" C HVT-FCC	Body Material:	Cast Iron
Line Size:	8	Throat Material:	316 Stainless
Pipe ID:	8.000 In. Throat ID: 5.6 In.	Flange Material:	Cast Iron
Tap Size:	3/4" NPT	Flange Type:	ANSI
		Flange Rating:	125

Application Conditions

Fluid:	WATER		Oper.Temp.:	60.00	°F	Base Temp.:	60.00	°F
State:	LIQUID		Oper.Press.:	20.00	psia	Base Press.:	20.00	psia
Maximum Flow:	2	MGD	Op.Sp.Gr.:	1.0000		Base Sp.Gr.:	1.0000	
Normal Flow:	1	MGD	Density:	62.375	Lb_m/ft^3			
Minimum Flow:	.5	MGD	Viscosity:	1.12	cp			

Beta Ratio 0.7000 **Discharge Coefficient 0.9900**

Calculated Values	At The Maximum Flow of: 2 MGD	At The Normal Flow of: 1 MGD	At The Minimum Flow of: .5 MGD
Differential Pressure =	47.38 In of water	11.84 In of water	2.96 In of water
Pipe Reynolds Number =	489719	244860	122430
Head Loss of Meter =	2.88 In of water	0.780 In of water	0.160 In of water
Random Error =	0.50 %	0.50 %	0.50 %
Bias Error =	0.0 %	0.0 %	0.0 %

Additional Notes

Primary Flow Signal

PRIMARY FLOW SIGNAL
FLOW VERSUS DIFFERENTIAL TABLE

Date:	8/10/2022			Model:	8" C HVT-FCC
Customer:	Eco-Tech Inc.			Line Size:	8
PFS Quote:	Q925-21			Throat Size:	5.600 Inches
Serial No.:	24489-01			Fluid:	WATER
Tag No.:				State:	LIQUID
Oper. Temp.	60.0 Deg. F			Pipe ID:	8.000 Inches
Oper. Press.	20.0 psia	TurnDown:	10 to 1	Increments:	0.02 MGD

FLOW MGD	DIFF. Inches Water	FLOW MGD	DIFF. Inches Water	FLOW MGD	DIFF. Inches Water	FLOW MGD	DIFF. Inches Water
2.00	47.38	1.56	28.83	1.10	14.33	0.660	5.16
1.98	46.44	1.54	28.09	1.08	13.82	0.640	4.85
1.96	45.50	1.52	27.37	1.06	13.31	0.620	4.55
1.94	44.58	1.50	26.65	1.04	12.81	0.600	4.26
1.92	43.66	1.48	25.94	1.02	12.32	0.580	3.98
1.90	42.76	1.46	25.25	1.00	11.84	0.560	3.71
1.88	41.86	1.44	24.56	0.980	11.38	0.540	3.45
1.86	40.98	1.42	23.88	0.960	10.92	0.520	3.20
1.84	40.10	1.40	23.22	0.940	10.47	0.500	2.96
1.82	39.23	1.38	22.56	0.920	10.03	0.480	2.73
1.80	38.38	1.36	21.91	0.900	9.59	0.460	2.51
1.78	37.53	1.34	21.27	0.880	9.17	0.440	2.29
1.76	36.69	1.32	20.64	0.860	8.76	0.420	2.09
1.74	35.86	1.30	20.02	0.840	8.36	0.400	1.90
1.72	35.04	1.28	19.41	0.820	7.96	0.380	1.71
1.70	34.23	1.26	18.80	0.800	7.58	0.360	1.54
1.68	33.43	1.24	18.21	0.780	7.21	0.340	1.37
1.66	32.64	1.22	17.63	0.760	6.84	0.320	1.21
1.64	31.86	1.20	17.06	0.740	6.49	0.300	1.07
1.62	31.09	1.18	16.49	0.720	6.14	0.280	.93
1.60	30.32	1.16	15.94	0.700	5.80	0.260	.80
1.58	29.57	1.14	15.39	0.680	5.48	0.240	.68
		1.12	14.86			0.220	.57

Ver. 4.2

PRIMARY FLOW SIGNAL

WORKING EQUATION FOR FLOW

Date:	8/10/2022	Model:	8" C HVT-FCC
Customer:	Eco-Tech Inc.	Line Size:	8
PFS Quote:	Q925-21	Throat Size:	5.6 In.
Serial No.:	24489-01	Fluid:	WATER
Tag No.:		State:	LIQUID

LIQUID FLOW
GAL/HR

$$Q_{GPH} = 339.9873\ (S)\ (F_A)\ (D^2)\ (FHM)\ (FG)\ (FG_B)$$

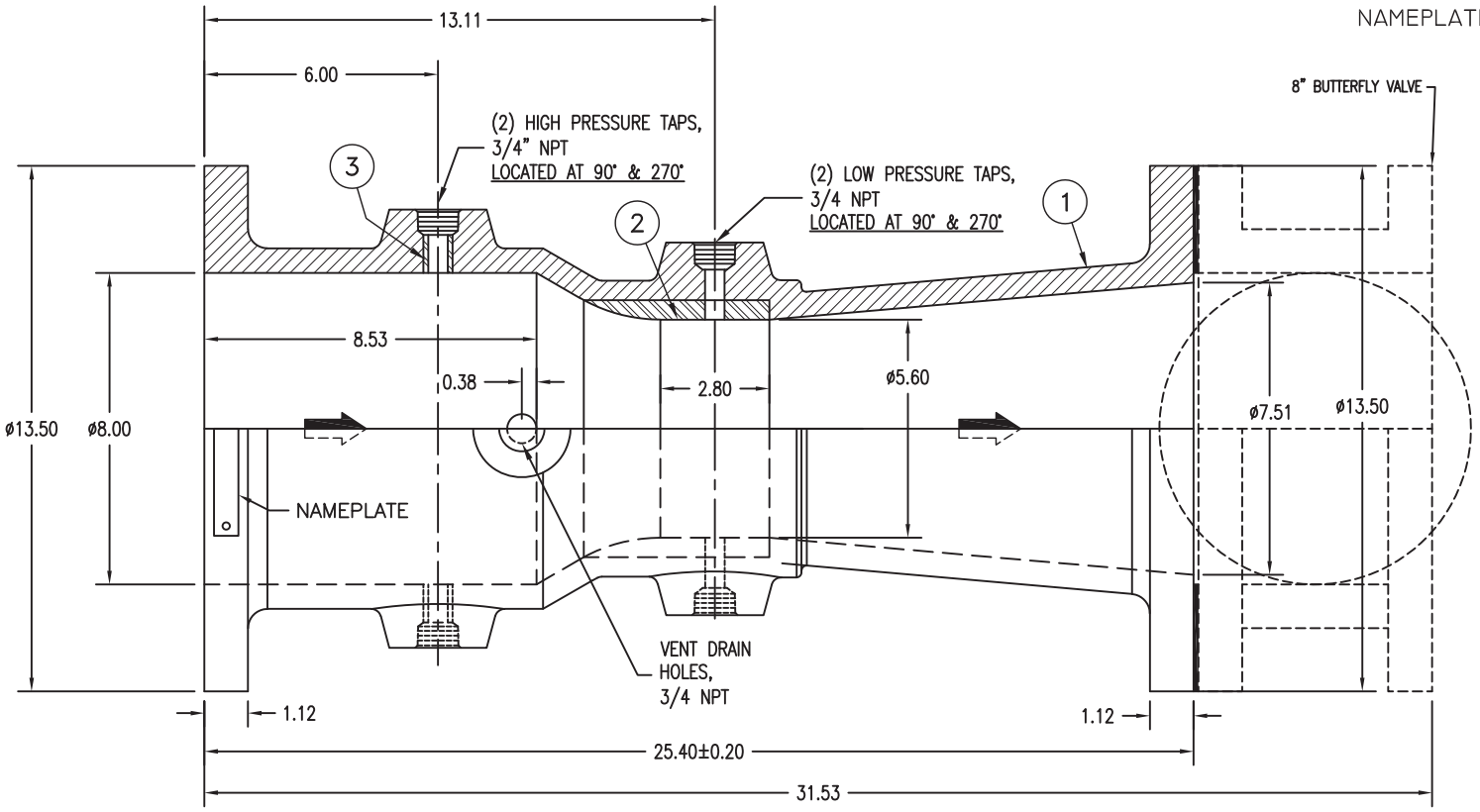
Q_{GPH}	=	83,333.33	Flow	
S	=	0.55648	Sizing Factor	$C_D\left(\frac{\beta^2}{\sqrt{1-\beta^4}}\right)$
F_A	=	0.9999	Area Expansion Factor	
D^2	=	64.	Pipe Diameter ^{2}	*(inches)²*
FHM	=	6.883	$\sqrt{\text{Diff. Pressure}}$	*(in. of water)½*
FG	=	1.000	$\sqrt{\text{Sp.Gravity}}$	
FG_B	=	1.000	$1/\text{BaseSp.Gravity}$	
C_D	=	.99	Discharge Coefficient	
β	=	0.700	Beta Ratio	$\text{ThroatDia.}/\text{PipeDia.}$

NOTE:
METER OUTLET PROVIDES CLEARANCE FOR DIRECT–COUPLED 8"ø BUTTERFLY VALVE w/ 6" LAYING LENGTH PROVIDED BY AND MOUNTED BY OTHERS.

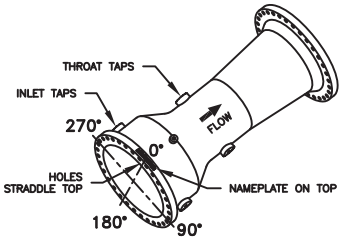
PRIMARY FLOW SIGNAL, INC.
RHODE ISLAND USA

MODEL:	8" C HVT-FCC
SIZE:	8.00" x 5.60"
SERIAL NO.:	24489-01-0_

NAMEPLATE INSTALLED AS SHOWN AT 0°



PLAN VIEW



FLANGE DRILLING	INLET	OUTLET
CLASS	125	125
NUMBER OF HOLES	8	8
DIAMETER OF HOLES	0.88	0.88
DIAM. OF BOLT CIRCLE	11.75	11.75
REFERENCED STANDARD	☐ AWWA	■ ANSI

HOLES EQUALLY SPACED, STRADDLE TOP

MATERIALS

1. BODY	■ CAST IRON, ASTM A126, GRADE B ☐ .	
2. THROAT	☐ 304 STAINLESS STEEL ■ 316 STAINLESS STEEL	☐ BRONZE ☐ .
3. SLEEVES & PLUGS	☐ 304 STAINLESS STEEL ■ 316 STAINLESS STEEL	☐ BRONZE ☐ .

PAINT (APPLICABLE TO CAST IRON SURFACES ONLY)

INTERIOR:	■ S.W. MACROPOXY 646 PW NSF 8 MILS MIN DFT
EXTERIOR:	■ S.W. MACROPOXY 646 PW NSF 8 MILS MIN DFT

ACCESSORIES: .

HYDROSTATIC TEST: 250 PSIG, 60 °F, 15 MINUTES

DESIGN CONDITIONS: ■ 150 PSIG ☐ 250 PSIG ☐ _____ ■ 150° F ☐ 250° F ☐ _____

SERIAL NUMBER	☐ TYVEK TAG NUMBER SS ■
24489-01-01	FILTER 1
24489-01-02	FILTER 2
24489-01-03	FILTER 3

PROJECT NAME: NORTHPORT WTP (AL) FILTERS 1-2-3

CERTIFIED: Brian Lesniak

REV	DESCRIPTION	DATE
A		
B		
C		
D		
E		

PRIMARY FLOW SIGNAL, INC.
800 WELLINGTON AVENUE
CRANSTON, RHODE ISLAND 02910-8479
TEL (401) 461-6366 FAX (401) 461-4450

DWG. NO.: FCC-8-C-24489-01

TITLE: 8.00" x 5.60" HVT-FCC

C EQUALS:	FLANGE DRILLING:	QUOTE NO.:
0.9900	ANSI CLASS 125	Q925-21
DRAWN:	**DATE:**	**SCALE:**
BL	8/10/22	1 : 5

STD. ■ SPECIAL ☐ _____ A B C D E F ☐☐☐☐☐☐ DIMENSIONS: INCHES

Protective & Marine Coatings

MACROPOXY® 646 PW
POTABLE WATER EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART A	B58RX610	RED
PART A	B58HX610	BUFF
PART B	B58VX600	HARDENER
PART B	B58VX605	OAP HARDENER

Revised: May 28, 2019

PRODUCT INFORMATION

4.56

PRODUCT DESCRIPTION

MACROPOXY 646 PW EPOXY is a high solids, high build, fast drying, polyamide epoxy classified by UL to ANSI/NSF 61 as a tank lining for potable water storage tanks. The high solids content ensures adequate protection of sharp edges, corners, and welds. B58VX605 Hardener contains Opti-Check OAP pigment technology for rapid holiday detection with safe blue light inspection lamps.

- Low odor
- Outstanding application properties

PRODUCT CHARACTERISTICS

Finish:	Semi-Gloss	
Color:	Mill White, Light Blue, Buff, and Red	
Volume Solids:	72% ± 2%, mixed	
Weight Solids:	85% ± 2%, mixed	
VOC (EPA Method 24): mixed	Unreduced:	<250 g/L; 2.08 lb/gal
	Reduced 10%:	<300 g/L; 2.50 lb/gal
Mix Ratio:	1:1 by volume	

Recommended Spreading Rate per coat:

	Standard Min.	Standard Max.	AWWA Min.	AWWA Max.
Wet mils (microns)	**7.0** 175	**13.5** 340	**4.2** 105	**8.3** 208
Dry mils (microns)	**5.0** 125	**10*** 250*	**3.0** 75	**6.0*** 150*
~Coverage sq ft/gal (m^2/L)	**116** 2.8	**232** 5.6	**192** 4.7	**384** 9.4
Theoretical coverage **sq ft/gal** (m^2/L) @ 1 mil/25 micron dft	**1152** (28.2)			

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

* See Recommended Systems on reverse side

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 40°F/4.5°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
Cure for immersion:	14 days	7 days	4 days
Pot Life:	10 hours	4 hours	2 hours
Sweat-in-Time:	30 minutes	30 minutes	15 minutes

If maximum recoat time is exceeded, abrade surface before recoating.

Drying time is temperature, humidity, and film thickness dependent.

For **Potable Water Service**, allow a minimum cure time of 7 days at 77°F (25°C) prior to placing in service. Sterilize and rinse per AWWA C652.

Shelf Life:	36 months, unopened Store indoors at 40°F (4.5°C) to 100°F (38°C).
Flash Point:	91°F (33°C), TCC, mixed
Reducer/Clean Up:	Reducer R7K15

RECOMMENDED USES

Potable Water Tank Restrictions
7 Day Cure; Tanks ≥ 1,500 gallons: 2-3 cts
Maximum DFT: 20.0 mils (up to 10 mils/ct)

21 Day Cure; Pipes ≥ 15", 2 cts
Maximum DFT: 8 mils/ct

- Conforms to AWWA D102 ICS #1, #2, and #5, and OCS #5***

***Refer to respective systems

Acceptable for use as a primer in an ablative antifouling system.

PERFORMANCE CHARACTERISTICS

Substrate*: Steel

Surface Preparation*: SSPC-SP10/NACE 2

System Tested*:

1 ct. Macropoxy 646 PW Fast Cure @ 6.0 mils (150 microns) dft

*unless otherwise noted below

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	84 mg loss
Adhesion	ASTM D4541	1,037 psi
Corrosion Weathering[1]	ASTM D5894, 36 cycles, 12,000 hours	Rating 10 per ASTM D714 for blistering; Rating 9 per ASTM D610 per rusting
Direct Impact Resistance	ASTM D2794 Modified	*120 in. lb.
Dry Heat Resistance	ASTM D2485	250°F (121°C)
Flexibility	ASTM D522, 180° bend, 3/4" mandrel	Passes
Humidity Resistance	ASTM D4585, 6000 hours	No blistering, cracking, or rusting
Immersion[2]	5 year potable water	Rating 10 per ASTM D610 for Rusting; Rating 10 per ASTM D714 for Blistering
Immersion	18 months fresh and salt water	Passes, no rusting, blistering, or loss of adhesion
Pencil Hardness	ASTM D3363	3H
Water Vapor Permeance	ASTM D1653, Method B	1.16 grains/day

* Performed on 1/16 inch blasted steel

Epoxy coatings may darken or discolor following application and curing.

Footnotes:

[1] Zinc Clad II Plus Primer

[2] Galvapac/2 cts Macropoxy 646 PW

continued on back

Protective & Marine Coatings

CERTIFIED UL WATER QUALITY

MACROPOXY® 646 PW
POTABLE WATER EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART A	B58RX610	RED
PART A	B58HX610	BUFF
PART B	B58VX600	HARDENER
PART B	B58VX605	OAP HARDENER

Revised: May 28, 2019

PRODUCT INFORMATION

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RECOMMENDED SYSTEMS

	Dry Film Thickness / ct. Mils	(Microns)
Immersion, Steel:		
***AWWA D102: Inside Coating System No. 1**		
minimum AWWA	8.0	(200)
1 ct. Macropoxy 646 PW	3.0	(75)
1 ct. Macropoxy 646 PW	5.0	(125)
***AWWA D102: Inside Coating System No. 2**		
minimum AWWA	12.0	(300)
1 ct. Macropoxy 646 PW	3.0	(75)
1 ct. Macropoxy 646 PW	4.0	(100)
1 ct. Macropoxy 646 PW	5.0	(125)
***AWWA D102: Inside Coating System No. 5**		
minimum AWWA	10.0	(250)
1 ct. Corothane I Galvapac	2.0	(50)
2 cts. Macropoxy 646 PW	4.0	(100)
Steel, forced cure (100 gallon minimum tank size or 15" or greater pipe diameter):		
2 cts. Macropoxy 646 PW	5.0-6.0	(125-150)

•12 mils maximum film thickness •Curing requirements
•Flash 2 hours @ 75°F (24°C)
•24 hours @ 150°F (66°C)
•24 hours @ 75°F (24°C)

Atmospheric, Steel:		
***AWWA D102: Outside Coating System No. 5**		
minimum	6.0	(150)
1 ct. Macropoxy 646 PW	2.0	(50)
1 ct. Macropoxy 646 PW	2.0	(50)
1 ct. Acrolon 218HS	2.0	(50)
***AWWA D102: Outside Coating System No. 6**		
minimum	6.0	(150)
1 ct. Corothane I GalvaPac PW	2.0	(50)
1 ct. Macropoxy 646 PW	2.0	(50)
1 ct. Acrolon 218HS	2.0	(50)
Concrete/Masonry, smooth:		
2 cts.Macropoxy 646 PW	3.0-6.0	(75-150)

Refer to UL.com for maximum dft restrictions

The systems listed above are representative of the product's use, other systems may be appropriate.

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

Iron & Steel
Atmospheric: SSPC-SP2/3
Immersion: SSPC-SP10/NACE 2, 2-3 mil (50-75 micron) profile

Concrete & Masonry
Immersion: SSPC-SP13/NACE 6-4.3.1 or 4.3.2, or ICRI No. 310.2R, CSP 1-3

Surface Preparation Standards

	Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal		Sa 3	Sa 3	SP 5	1
Near White Metal		Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast		Sa 2	Sa 2	SP 6	3
Brush-Off Blast		Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	C St 2	SP 2	-
	Pitted & Rusted	D St 2	D St 2	SP 2	-
Power Tool Cleaning	Rusted	C St 3	C St 3	SP 3	-
	Pitted & Rusted	D St 3	D St 3	SP 3	-

TINTING

Do not Tint.

APPLICATION CONDITIONS

Temperature: 40°F (4.5°C) minimum, 110°F (43°C) maximum (material)
40°F (4.5°C) minimum, 140°F (60°C) (air and surface)
At least 5°F (2.8°C) above dew point

Relative humidity: 85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:
Part A: 1 gallon (3.78L) and 5 gallon (18.9L) containers
Part B: 1 gallon (3.78L) and 5 gallon (18.9L) containers

Weight: 12.7 ± 0.2 lb/gal ; 1.5 Kg/L mixed, may vary by color

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Protective & Marine Coatings

CERTIFIED UL WATER QUALITY

MACROPOXY® 646 PW
POTABLE WATER EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART A	B58RX610	RED
PART A	B58HX610	BUFF
PART B	B58VX600	HARDENER
PART B	B58VX605	OAP HARDENER

Revised: May 28, 2019

APPLICATION BULLETIN

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SURFACE PREPARATIONS

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Carbon Steel, Immersion Service:
Clean and degrease the surface prior to abrasive blasting per SSPC-SP 1 Solvent Cleaning. Methods described in SSPC-SP 1 include solvents, alkali, detergent/water, emulsions, and steam. The surface shall be abrasive blasted to SSPC-SP10/NACE No. 2 Near-White Blast Cleaning with a 2-3 mil (50-75 micron) profile. The anchor pattern shall be sharp with no evidence of a polished surface. The finished surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter with no more than 5% staining. After blasting, all dust and loose residue should be removed from the surface by acceptable means. Coat steel the same day as it is prepared and prior to the formation of rust.

Iron & Steel, Atmospheric Service:
Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6/NACE 3, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel within 8 hours or before flash rusting occurs.

Ductile Iron, Immersion Service:
Refer to National Association of Pipe Fabricators Surface Preparations Standard NAPF 500-03 as follows:

a. NAPF 500-03-01 "Solvent Cleaning"
b. NAPF 500-03-02 "Hand Tool Cleaning"
c. NAPF 500-03-03 "Power Tool Cleaning"
d. NAPF 500-03-04 "Abrasive Blast Cleaning of Ductile Iron Pipe".

Concrete and Masonry
For surface preparation, refer to SSPC-SP13/NACE 6, or ICRI No. 310.2R, CSP 1-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with Steel-Seam FT910.

Follow the standard methods listed below when applicable:
ASTM D4258 Standard Practice for Cleaning Concrete.
ASTM D4259 Standard Practice for Abrading Concrete.
ASTM D4260 Standard Practice for Etching Concrete.
ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.
SSPC-SP 13/Nace 6 Surface Preparation of Concrete.
ICRI No. 310.2R Concrete Surface Preparation.

Concrete, Immersion Service:
For surface preparation, refer to SSPC-SP13/NACE 6, Section 4.3.1 or 1.3.2 or ICRI No. 310.2R, CSP 1-3.

Previously Painted Surfaces:
If in sound condition, clean the surface of all foreign material. Scarify the surface to create the desired surface profile. Apply coatings on a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary.

Surface Preparation Standards

	Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal		Sa 3	Sa 3	SP 5	1
Near White Metal		Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast		Sa 2	Sa 2	SP 6	3
Brush-Off Blast		Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	C St 2	SP 2	-
	Pitted & Rusted	D St 2	D St 2	SP 2	-
Power Tool Cleaning	Rusted	C St 3	C St 3	SP 3	-
	Pitted & Rusted	D St 3	D St 3	SP 3	-

APPLICATION CONDITIONS

TTemperature:	40°F (4.5°C) minimum, 110°F (43°C) maximum (material) 40°F (4.5°C) minimum, 140°F (60°C) (air and surface) At least 5°F (2.8°C) above dew point
Relative humidity:	85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean Up ..... Reducer R7K15

Airless Spray
Pump.....30:1
Pressure.....2800 - 3000 psi
Hose.....1/4" ID
Tip .....017" - .023"
Filter .....60 mesh
Reduction.....As needed up to 10% by volume

Brush
Brush.....Nylon/Polyester or Natural Bristle
Reduction.....As needed up to 10% by volume

Roller
Cover .....3/8" woven with solvent resistant core
Reduction.....As needed up to 10% by volume

Recommended Spreading Rate per coat:

	Standard	AWWA
Wet mils (microns):	7.0 (175) - 13.5 (340)	4.2 (105) - 8.3 (208)
Dry mils (microns):	5.0 (125) - 10.0* (250)	3.0 (75) - 6.0* (150)
Coverage:	116 (2.8) - 232 (5.6) sq ft/gal (m^2/L)	192 (4.7) - 384 (9.4)

*See recommended systems on Product Information page

If specific application equipment is not listed above, equivalent equipment may be substituted.

continued on back

Protective & Marine Coatings

CERTIFIED UL WATER QUALITY

MACROPOXY® 646 PW
POTABLE WATER EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART A	B58RX610	RED
PART A	B58HX610	BUFF
PART B	B58VX600	HARDENER
PART B	B58VX605	OAP HARDENER

Revised: May 28, 2019

APPLICATION BULLETIN

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APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with low speed power agitation. Make certain no pigment remains on the bottom of the can. Then combine one part by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated prior to application. Re-stir before using.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Standard		AWWA	
	Min.	Max.	Min.	Max.
Wet mils (microns)	**7.0** 175	**13.5** 340	**4.2** 105	**8.3** 208
Dry mils (microns)	**5.0** 125	**10*** 250*	**3.0** 75	**6.0*** 150*
~Coverage sq ft/gal (m^2/L)	**116** 2.8	**232** 5.6	**192** 4.7	**384** 9.4
Theoretical coverage **sq ft/gal** (m^2/L) @ 1 mil/25 micron dft	**1152** (28.2)			

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

* See Recommended Systems on reverse side

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 40°F/4.5°C	@ 77°F/25°C *50% RH*	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
Cure for immersion:	14 days	7 days	4 days
Pot Life:	10 hours	4 hours	2 hours
Sweat-in-Time:	30 minutes	30 minutes	15 minutes

If maximum recoat time is exceeded, abrade surface before recoating.

Drying time is temperature, humidity, and film thickness dependent.

For **Potable Water Service**, allow a minimum cure time of 7 days at 77°F (25°C) prior to placing in service. Sterilize and rinse per AWWA C652.

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer R7K15. Clean tools immediately after use with Reducer R7K15.

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, over thinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, adhesion and UL ANSI/ NSF 61 approval.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R7K15.

Tinting is not recommended for immersion service.

Quik-Kick Epoxy Accelerator is acceptable for atmospheric use.

Do not use Quik-Kick Epoxy Accelerator for immersion ser-vice when UL certification is required.

Insufficient ventilation, incomplete mixing, miscatalyzation, and external heaters may cause premature yellowing.

Excessive film build, poor ventilation, and cool temperatures may cause solvent entrapment and premature coating failure.

For Immersion Service: (if required) Holiday test in accordance with ASTM D5162 for steel, or ASTM D4787 for concrete.

Guidance on techniques and required equipment to inspect a coating system incorporating Opti-Check OAP Technology can be found in SSPC-TU 11.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

C Accuracy and Reliability

Summary of Calibration Data

Nominal Inlet Diameter	Beta Ratio	Flow Calibration Facility	Standard HVT Discharge Coefficient	Inlet Tap Factor	Actual Discharge Coefficient	Flow Calibrated Discharge Coefficient	Discharge Coefficient Deviation	n
2.00	0.4822	ARL, Bldg. 2 - 10 000 lb Tank	0.9900	1.0000	0.9900	0.9888	-0.12%	1
2.00	0.5018	ARL, Bldg. 2 - 10 000 lb Tank	0.9900	1.0000	0.9900	0.9919	+0.19%	2
6.00	0.3142	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9935	+0.35%	3
6.00	0.4730	ARL, Bldg. 2 - 10 000 lb Tank	0.9900	0.9884	0.9785	0.9748	-0.38%	4
6.00	0.5999	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9906	+0.06%	5
6.00	0.5999	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9899	-0.01%	6
6.00	0.5999	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	0.9814	0.9716	0.9728	+0.12%	7
6.00	0.5999	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9814	0.9716	0.9720	+0.04%	8
10.00	0.3601	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9868	-0.32%	9
10.00	0.4738	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	0.9907	0.9808	0.9827	+0.19%	10
10.00	0.7059	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9912	+0.12%	11
10.00	0.7060	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9907	+0.07%	12
10.00	0.7060	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9917	+0.17%	13
10.00	0.7507	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	0.9452	0.9357	0.9365	+0.08%	14
10.00	0.7507	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9452	0.9357	0.9362	+0.05%	15
10.00	0.7555	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	0.9432	0.9338	0.9364	+0.28%	16
12.00	0.5875	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9934	+0.34%	17
12.00	0.5875	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9779	0.9681	0.9716	+0.36%	18
18.00	0.4996	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	1.0000	0.9900	0.9865	-0.35%	19
18.00	0.4996	ARL, Bldg. 2 - 50 000 lb Tank	0.9900	0.9916	0.9817	0.9805	-0.12%	20
20.00	0.6307	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9922	+0.22%	21
24.00	0.5240	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9899	-0.01%	22
24.00	0.5240	ARL, Bldg. 2 - Master	0.9900	0.9897	0.9798	0.9790	-0.08%	23
24.00	0.5262	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9923	+0.23%	24
24.00	0.5262	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9874	-0.26%	25
24.00	0.5263	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9909	+0.09%	26
24.00	0.5378	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9832	0.9734	0.9755	+0.22%	27
29.00	0.5184	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9898	-0.02%	28
29.00	0.5184	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9902	0.9803	0.9812	+0.09%	29
29.00	0.5205	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9891	-0.09%	30
29.00	0.5205	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9900	0.9801	0.9812	+0.11%	31
29.00	0.5206	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	1.0000	0.9900	0.9897	-0.03%	32
29.00	0.5206	ARL, Bldg. 1 - 100 000 lb Tank	0.9900	0.9900	0.9801	0.9798	-0.03%	33
36.00	0.5828	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9867	-0.33%	34
36.00	0.5828	ARL, Bldg. 2 - Master	0.9900	0.9836	0.9738	0.9721	-0.17%	35
48.00	0.5271	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9895	-0.05%	36
48.00	0.5271	ARL, Bldg. 2 - Master	0.9900	0.9894	0.9795	0.9778	-0.17%	37
48.00	0.5294	ARL, Bldg. 2 - Master	0.9900	1.0000	0.9900	0.9894	-0.06%	38
48.00	0.5294	ARL, Bldg. 2 - Master	0.9900	0.9893	0.9794	0.9829	+0.36%	39

Reynolds Number Range: 60 000 to 4 300 000

- σ = Standard Deviation = $\pm\sqrt{\frac{\Sigma\Delta C^2}{n-1}}$ = ± 0.202% of C
- R = Reproducibility of C for a New Meter = 2σ = ± 0.404% of C
- P = C Precision = $\pm\frac{t \times \sigma}{\sqrt{n}}$ = ± 0.065% of C

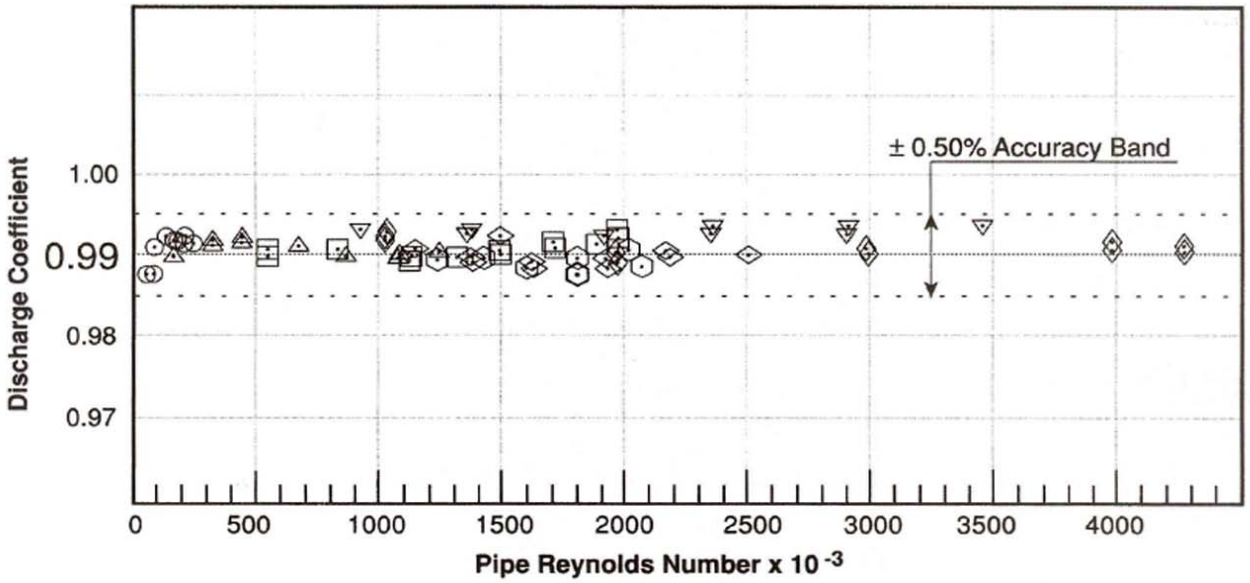
  t = 2.02 = Student's t for 95% confidence level for 38 (n - 1) degrees of freedom
- A_B = Bench Calibrated C Accuracy = $\pm\sqrt{P^2 + R^2}$ = ± 0.41 % of C

Certified by: _____
D. Halmi, Engineering

Primary Flow Signal, Inc.,
800 Wellington Avenue, Cranston RI 02910, Ph: 877-737-3569, Fax: 401-461-4450

C Accuracy and Reliability

HVT Discharge Coefficient
Pipe Reynolds Number Behavior



⊙ 2" HVT-FV ß= 0.5018 10 000 lb Facility, 47°
△ 6" HVT-FV ß= 0.5999 50 000 lb Facility, 79°
◇ 10" HVT-CI ß= 0.7060 100 000 lb Facility, 98°
▽ 12" HVT-PS ß= 0.5875 100 000 lb Facility, 93°
⊡ 24" HVT-CI ß= 0.5263 Master Facility, 72°
◈ 30" HVT-CI ß= 0.5184 100 000 lb Facility, 80°
⊙ 48" HVT-CI ß= 0.5271 Master Facility, 70°

Note:
Flow calibrations were performed at Alden Research Laboratory, Inc., Holden, Massachusetts in the flow calibration facilities shown.

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Design Tools

Differential Producers – Working Flow Equations

The basic flow equation is derived in Section D. From this equation we compose the following working flow equations, each of which has a constant. The constants modify the ideal flow equation (Section D) for the flow and time units to be used; for the preference of using inches for length rather than feet; and for the fact that the ideal flow equation uses the differential pressure expressed in feet of line fluid at line temperature and pressure while the working equations use inches of water at 68° F, 14.7 PSIA.

$$\text{Equation 1:}\quad Q = \frac{\text{Constant}\ d^2\ C\ Y\ F_a \sqrt{h_w \frac{g}{g_o}}}{\sqrt{1-\beta^4}\ \sqrt{\rho_1}}$$

$$\text{Equation 2:}\quad Q = \frac{\text{Constant}\ d^2\ C\ Y\ F_a \sqrt{\rho_1 h_w \frac{g}{g_o}}}{\sqrt{1-\beta^4}}$$

$$\text{Equation 3:}\quad SCFM = \frac{5.982\ d^2\ C\ Y\ F_a \sqrt{\rho_1 h_w \frac{g}{g_o}}}{\sqrt{1-\beta^4}\ \rho_s}$$

Constants:	Cubic Feet Eq. 1	Gallons Eq. 1	Liters Eq. 1	Pounds Eq. 2
Second	0.09970	0.7458	2.823	0.09970
Minute	5.982	44.748	169.39	5.982
Hour	358.92	2684.9	10163.2	358.92
Day	8614.1	64438.0	243197.0	8614.1

Symbol…Explanation…Unit

A_B = Accuracy of Bench Calibrated C.... ±% of C
A_F = Accuracy of Flow Calibrated C.... ±% of C
C = Coefficient of Discharge .... Ratio
C_B = Bench Calibrated C .... Ratio
C_F = Flow Calibrated C .... Ratio
D = Inlet Diameter .... Inches
d = Throat Diameter .... Inches
F_a = Thermal Expansion Factor ..... Ratio
g = Local Gravitational Acceleration ..... ft/sec²
g_o = Standard Gravitational Acceleration ... ft/sec² (g_o = 32.174 ft/sec²)
G = Specific Gravity .....Ratio
HL = Headloss in % of differential....%
HL_b = Headloss at R_{Db}....%
h_w = Differential Pressure ... Inches of Water 68°F, 14.7 PSIA

$$I_C = \text{Cavitation Index} = \frac{144\ (P_1 - 0.0361\ h_w - P_w)}{VH_2\ \rho_2}$$

P_w = Liquid Vapor Saturation Pressure at Line Pressure .....PSIA
P_1 = Inlet Static Pressure ....PSIA
P_2 = Throat Static Pressure .... PSIA
R_D = Pipe Reynolds Number... Ratio
R_D= (6.32 x lb/hr)/μD
R_{Db}= R_D Value at Which HL_b Was Determined .... Ratio
RH = Relative Humidity .... %
T_1 = Inlet Temperature ..... °R
VH_1 = Velocity Head in Inlet ... Ratio

$$VH_1 = \frac{V_1^2}{64.348}$$

VH_2 = Velocity Head in Throat ... Ratio
V_1 = Average Inlet Velocity .... ft/sec
V_2 = Average Throat Velocity .... ft/sec
Y = Expansion Factor ... Ratio
Z_1 = Compressibility Factor at Inlet Conditions ... Ratio
ß = d/D = Beta Ratio .... Ratio
μ = Absolute Viscosity ... centipoise
ρ_s = Fluid Density at Standard Conditions ... lb/ft³
ρ_1 = Fluid Density at Inlet Conditions ... lb/ft³
ρ_2 = Fluid Density at Throat Conditions ... lb/ft³

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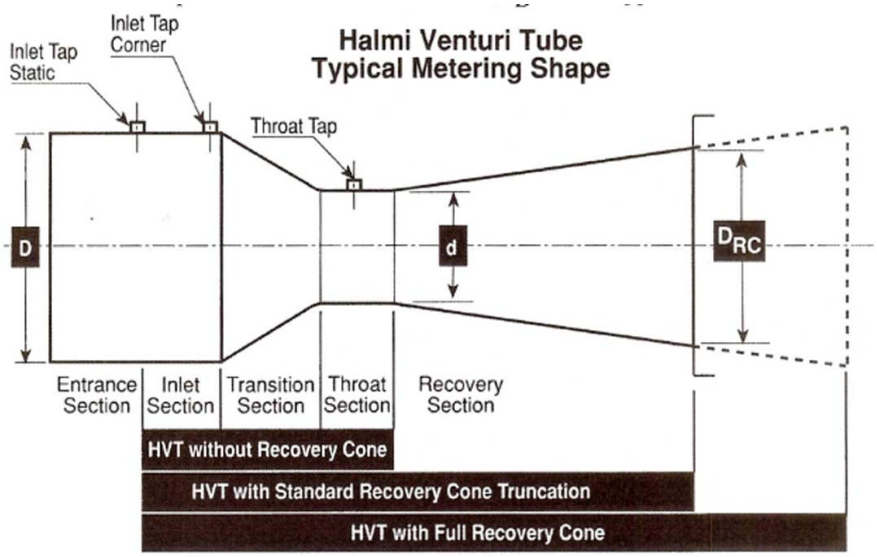
HVT- Headloss

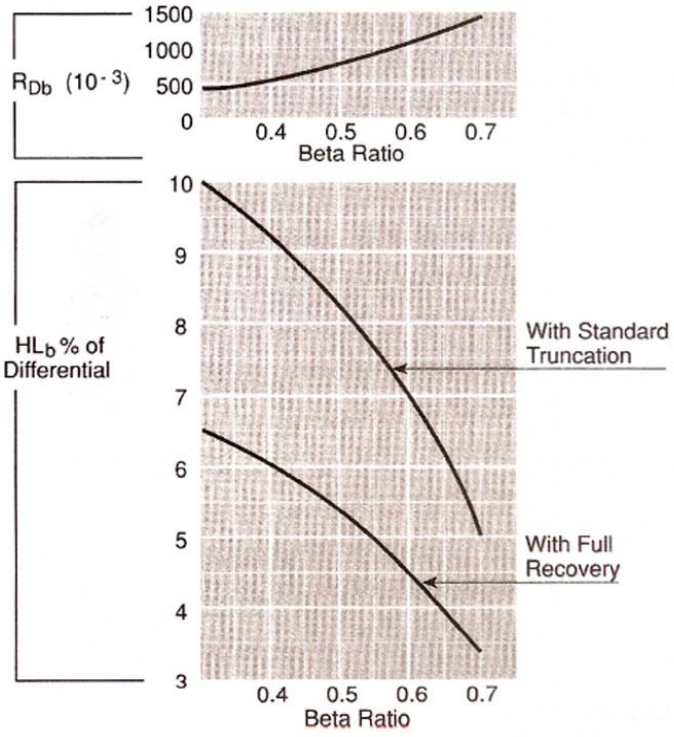
HVTs do "**metering work**" by accelerating the line fluid from inlet to throat velocity to generate the flow signal, i.e. the differential pressure. The higher throat velocity must then be decelerated to full pipe velocity which cannot be achieved without energy loss. This energy loss, called headloss, is the price of the unique reliability that HVT meters provide. "Since the flow signal is the result of the "work" the HVT metering shape performs on the line fluid, it is largely independent of the effects of different upstream piping configurations. HVT headloss can be calculated from the graph below, according to the metering shape used, beta ratio and pipe Reynolds number (R_D) of the application.



Note:

Standard Cast Iron HVTs (HVT-CI) and standard Plastic Insert HVTs (HVT-PI) have standard recovery cone truncation as shown. Full recovery Cones are available at an additional cost.

$$HL = HL_b \left(\frac{R_D}{R_{Db}}\right)^{-0.12} = \text{Headloss \% of } h_w \text{ at any } R_D$$



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Effects of Installation

The differential pressure produced by an HVT is, to a governing extent, an indirect indication of the difference in kinetic energy content of the flowing fluid at the inlet and throat tap cross sections of the meter. Since the same flow rate can possess different kinetic energy contents (depending on the approaching flow pattern), that same flow rate can produce different differential pressures, thus causing errors in the indicated rate of flow.

Irregular flow patterns, which alter the "normal" C value and/or behavior, can be caused by the individual or combined effects of:

- Pipe Reynolds Number (R_D)
- Pipe surface roughness, shape and diameter irregularities.
- Upstream fittings (elbow, increaser, etc.)
- Downstream fittings. For HVTs with full or truncated recovery cones, this effect is zero.

The C effect of R_D is treated in Section E. The C effects of some common fittings are shown in the "Typical Installation Effect" chart on page B-10. From it we may conclude:

1. Corner inlet tapping increases the flow pattern sensitivity.
2. The C effect of non-rotational irregular flow patterns caused by a decreaser, increaser, single elbow or tee are self-attenuating, the longer the upstream straight pipe, the lesser the effect.
3. The single elbow C effect is sensitive to orientation but preserves the direction of the effect, i.e., in the same orientation at different cross sections, the sign of the C deviation stays the same. Consequently, HVTs should be tapped as shown to permit the use of the presented data.
4. Diminishing the beta ratio diminishes the C effect.
5. Rotational flow patterns (two elbows, for example, direct-coupled in orthogonal planes) cause self-preserving C effects (40 pipe diameters of straight pipe between the disturbance and the meter are not enough to eliminate errors). Also, the errors vary in magnitude and sign with distance after the location of the disturbance, keeping orientation constant.

The following tools are offered for reducing the effects of irregular flow patterns:

- Use a smaller beta ratio.
- Use static inlet tapping instead of corner inlet tapping.
- Use a longer straight pipe upstream.
- Use flow straighteners for normalizing rotational flow patterns, but consult PFS before using them. **Improper use of flow straighteners can introduce greater errors than the ones they are expected to eliminate!**

Normal Flow Pattern Effects

A review of the thoughts presented on the next page should help achieve the required field installed accuracy for HVTs with reliability.

Both experience and theory indicate that different flow calibrations performed on a flow meter in different water calibrating facilities can yield different C values. This deviation, however, may be significantly greater than can be accounted for in the precision of the C data and justifiable bias errors in the flow calibrations. Given properly designed hydraulic laboratories with properly executed flow calibrations, the precision of C is calculated from the calibration data, while the bias errors are estimates based on "historical" data. Since the precision and bias are "known", the only recognized "unknown" is the effect which laboratory flow patterns (judged "normal") have on the discharge coefficient of the flow meter.

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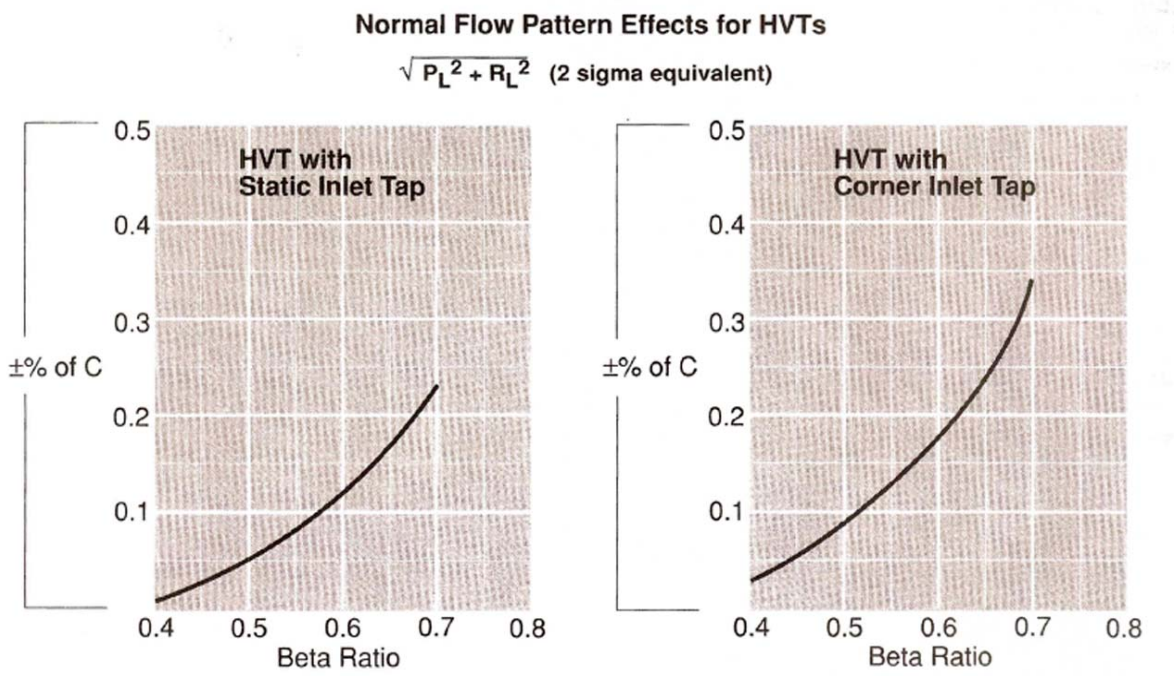
Normal Flow Pattern Effects (Continued)

In the past, much frustration and confusion have been caused due to the lack of satisfactory treatment of "normal" flow pattern effects. PFS has solved this "puzzles" by introducing the term "normal" flow pattern effects, where:

A flow pattern is considered normal for a given meter or meter type if the C effect of the flow pattern is less than the accuracy of the flow calibration.

The far reaching importance of this definition is recognition of the fact that different flow patterns can act as normal or irregular, depending on the flow pattern sensitivity of different types of devices (HVTs versus orifice plate), or of different characteristics of the same type of device (beta ratios of HVTs, number of paths in ultrasonic flow meters, length and design of electromagnetic flow meters). Since flow patterns can be only judged as "normal" and since those judgments cannot be made without error, we account for such errors by introducing the "normal flow pattern effect" in the HVT accuracy calculation, as shown below:



This graph provides guidance as to how the most benefit can be obtained after the decision has been made to invest in the flow calibration of an HVT. Use either:

- A small beta HVT (preferably 0.50000 or less) with no or just a short length of pipe (two pipe diameters long) permanently attached to the upstream end of the meter, or
- A larger beta HVT with a longer length of upstream pipe permanently attached to the device. Permanently attaching a length of pipe to the upstream end of the meter reduces the C error that could be caused by differences in the C controlling physical characteristics of the pipe which precede the meter or metering section at the flow calibrations, as opposed to that which will precede it in the field.

When a length of upstream pipe permanently attached to the HVT is included in the flow calibration, the flow calibrated C accuracies given in "Discharge Coefficient Summary" (page B-2) can be improved since part of the "normal flow pattern effect" is removed. (The magnitude of improvement depends on several parameters. Consult PFS for estimates.)

The bench calibrated C accuracy, as given on page B-2 includes the normal flow pattern effect and can be obtained when the installation possesses normal flow patterns.

In the case of critical installation, consult PFS.

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Typical Installation Effects

The table below was derived from flow test data. The accuracy of the tests, in view of the purpose for which they are used, is +/-[0.25(β/0.7)^4]%. Metering similar flow disturbers should give similar effects. Since HVTs have sufficiently long recovery cones, a flow disturber coupled directly to its outlet will have no effect on the throat pressure sensation. Thus, it does not impair the accuracy of the flow measurement. The table below should be used as follows:

- To secure the "normal" accuracy for the flow measurement, the HVT should be located at a distance following the disturber as indicated on the graph for the type of disturber, inlet tapping and beta ratio of the HVT.
- If there is insufficient piping available to secure normal accuracy, read the disturbance effect from the graph for the beta used and for the length of upstream pipe available.

Calculate the accuracy for the metering section as follows:

Installed Accuracy= A_B + ΔC)
where A_B from page E-5 is:
For static inlet tapped HVTs,

β	A_B
0.5000	+/-0.50%
0.6000	+/-0.50%
0.7000	+/-0.50%

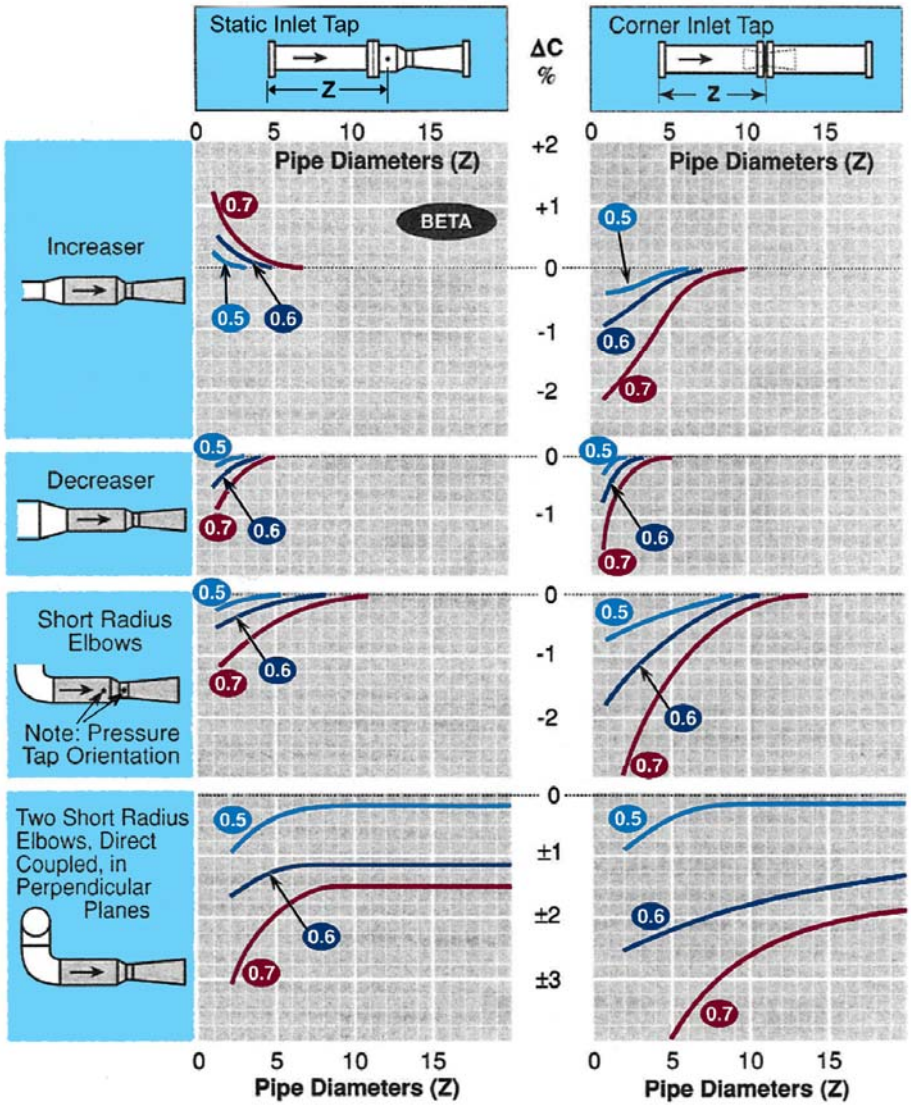
For corner inlet tapped HVTs,

β	A_B
0.5000	+/-0.50%
0.6000	+/-0.50%
0.7000	+/-0.53%

- Use flow straighteners only to stop swirls as in the case of two elbows which are direct-coupled in 90° planes. Contact PFS for design.

  Improperly used straighteners may cause greater errors than the ones they are supposed to eliminate.

- For the effects of other types of disturbers or of disturbers in series, contact PFS.



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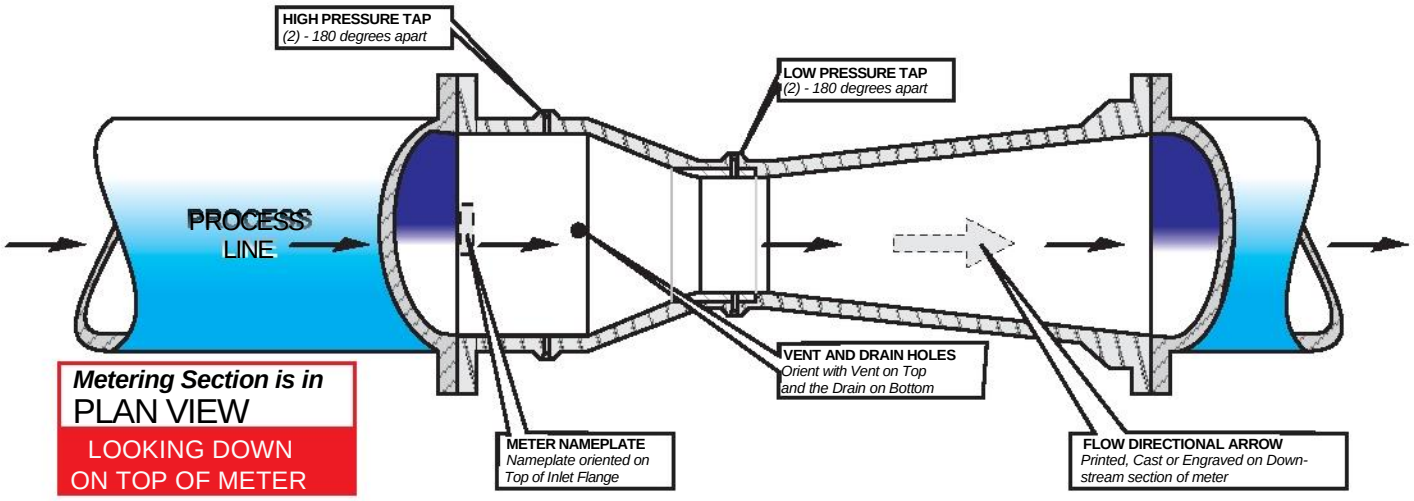
Installation Procedures

The Proper Method of Installing a Halmi Venturi Meter
PRESSURE VESSEL DESIGN



Caution:

- This is a high quality flow meter!
- Installer is responsible for proper field installation per appropriate codes and consistent with proper piping and pipe component installations (Referenced codes: ASME - PCC-1, B16.1, B16.5, B16.42, B16.47; AWWA - C110, C111, C207)
- Proper care and protection of the meter is the responsibility of the installer as regards to field hydro-testing of any line(s) that the meter is installed into.
- If damaged, it must be replaced! Damage to the meter resulting from improper installation, improper hydro-testing or any other operation performed by the installer are the responsibility of the installer.
- Handle it from its outside! - Do not damage its inside!
- Install meter in the pipe line so that the "Flow Directional Arrow" agrees with the direction of the flow! Orient Pressure Taps HORIZONTALLY! If improperly installed it must be reinstalled!
- Use gaskets appropriate for use with the flange materials! METAL GASKETS SHOULD NOT BE USED WITH GREY IRON OR DUCTILE IRON FLANGES! Gaskets must not protrude into flow!
- Unless expressly stated in Submittal or O & M manual, mechanical interference may occur when direct coupling a butterfly valve to downstream flange of meter!
- Align meter carefully with the process piping! Pipe flanges must be parallel and properly aligned to prevent damaging the Meter flanges. DO NOT OVER-TORQUE BOLTS! DO NOT USE METER AS PIPE SUPPORT!
- Provide necessary clearances as deemed practical for installation, inspection and maintenance!
- Tolerances should be within industry standards for the above installation instructions!
- Impulse piping to secondary instrumentation should be corrosion resistant, sized and installed in accordance with the instrumentation manufacturer's instructions!

- - -FAILURE TO FOLLOW ABOVE DIRECTIONS MAY VOID WARRANTY! - - -

PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS PFS

THE LEADER IN RELIABLE FLOW MEASUREMENT

PRIMARY FLOW SIGNAL, INC.

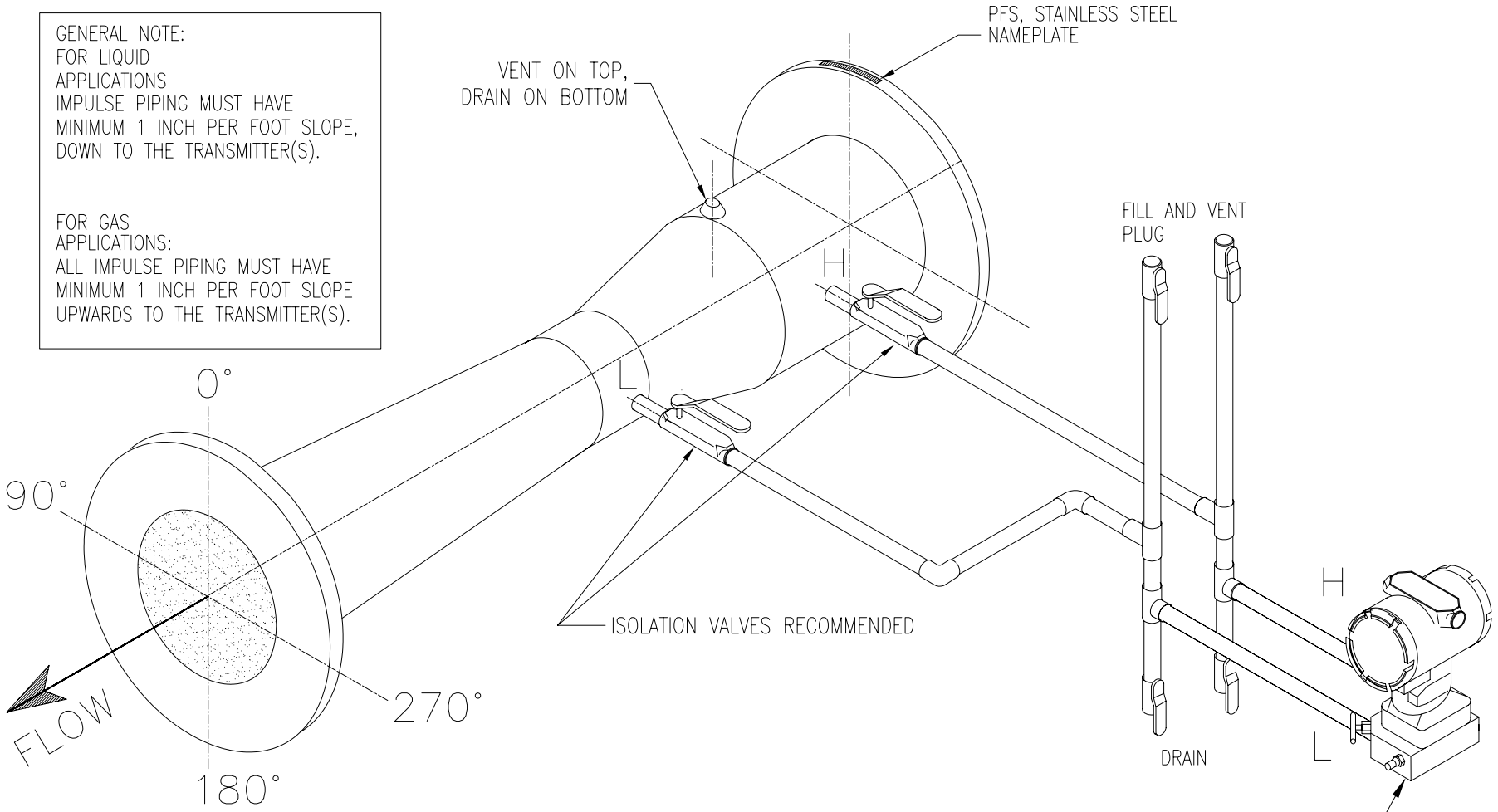
1-877-PFS-FLOW

HEADQUARTERS LOCATION:
800 WELLINGTON AVENUE CRANSTON RI USA 02910
TEL: (401)-461-6366 FAX: (401)-461-4450

http :\\www.primaryflowsignal.com

GENERAL NOTE:
FOR LIQUID APPLICATIONS
IMPULSE PIPING MUST HAVE MINIMUM 1 INCH PER FOOT SLOPE, DOWN TO THE TRANSMITTER(S).

FOR GAS APPLICATIONS:
ALL IMPULSE PIPING MUST HAVE MINIMUM 1 INCH PER FOOT SLOPE UPWARDS TO THE TRANSMITTER(S).



METER INSTALLED WITH PFS NAMEPLATE ON TOP AT 0°
HIGH AND LOW TAPS ON HORIZONTAL CENTERLINE AT 90, 270°

NOTE: TRANSMITTER MANUFACTURER SHOULD BE CONSULTED FOR THEIR RECOMMENDED MOUNTING ORIENTATION.

DATE:	SCALE:	IDENTIFICATION:
8/26/04	1/16	GENERAL PIPING FOR SINGLE RANGE METERING
DWN BY: DAB	QUOTE:	

PRIMARY FLOW SIGNAL, INC.
800 WELLINGTON AVE.
CRANSTON, RHODE ISLAND 02910
TEL (877) 737-3569 FAX (401) 461-4450

Start-Up Procedures

Determine that the meter is properly installed. The venturi meter is a piping component and should be handled accordingly with the same precautions. DO NOT HANDLE METER FROM ITS INSIDE.

Determine that the pressure connections are properly made and are appropriate for the intended service.

Determine that the meter has been installed in strict conformance with the “Installation Directions” included in this manual.

Do not over-pressurize meter. Refer to approval drawing for design pressure.

Do not subject meter to shock pressures or water hammer.

When filling pipe line, bleed-off air in the proper fashion.

Determine that pressure piping to secondary instrumentation is installed correctly.

If the meter appears damaged in any way, contact the local PFS Sales Representative or service organization, or contact Primary Flow Signal, Inc. directly.

Shut-Down Procedures

If it is necessary to isolate the differential pressure signal from the secondary instrumentation, close the isolation valves (if provided) and disconnect impulse piping. If secondary instrumentation is to be disconnected for an extended period, use pipe plugs appropriate for the line pressure.

If the meter is to be removed from the line for any reason, depressurize and drain the pipe line. Move meter with slings or strapping appropriate for the weight and geometry of the meter.

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Preventive Maintenance

1. Check Flange and Pressure Tap Connections for Leaks	Annually	By Instrumentation Operator or Mechanical Personnel
2. Inspect Exterior Finish for Scrapes, Dings, or Blistering	Annually	By Instrumentation Operator or Mechanical Personnel

- No special tools or skills are necessary for preventive maintenance tasking.
- No preventive maintenance parts list applicable.

Corrective Maintenance

In case of loss-of-signal or erratic output, check taps and impulse piping to secondary instrumentation for blockage or debris. Check impulse piping for leaks, trapped condensation (in the case of compressible gas flow), or trapped air (in the case of liquid flow.) In case of blockage, purge lines with air or water (as is appropriate) pressurized to approximately 30 PSI above line pressure.

WARNING: IN NO CASE SHOULD FLUSHING PRESSURE EXCEED THE DESIGN PRESSURE OF THE PROCESS OR IMPULSE PIPING.

In case of trapped condensate or trapped air, remove by use of bleed valves or plugs, or through the manifold at the flow transmitter.

Stop leaks by tightening, resealing, or regasketing as necessary.

Touch-up exterior finish with the same or a compatible coating system as necessary.

There are no test points, adjustments, or user-serviceable parts in the HVT venturi meter, nor is there any assembly or disassembly. If the problems persist, contact the local PFS Sales Representative or service organization, or contact Primary Flow Signal, Inc. directly.

- Corrective maintenance can be performed by mechanical or plant personnel.
- No special tools are required for corrective maintenance.

Spare Parts

The venturi meters provided on this project were designed and manufactured specifically for this project. The HVT project has no moving or parts.

There is no parts list and there is no recommended stocking level.

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Fax 401-461-4450

Storage Requirements

Cast Iron, Ductile Iron, and Fabricated Pressure Vessel Venturi Flow Meters

Indoor Storage:

- The venturi flow meters can be stored indefinitely indoors in a clean, non-corrosive environment. If environment is not clean, meters must be covered.
- Meters should be stored away from high traffic areas in order to minimize damage risk.
- Meters must not be stacked.
- Flanged meters may have bare iron or steel flange faces, or lightly primed flange faces as required by the specification.
- If meters will be stored in humid or corrosive areas, the flange faces may need to be coated with a suitable rust preventative. Note that any coating or sealant may need to be removed prior to installation; refer to the specification and applicable standards or codes. Temperature and humidity fluctuations should be minimized.
- Prolonged exposure to sunlight or other ultraviolet sources (fluorescent lights, etc.) may discolor, degloss, or chalk the exterior finish. See specific meter coating information.
- If storage is to be long-term, it is recommended that meters be covered with a tarp or heavy plastic sheeting.

Outdoor Storage - Short-Term (less than 3 months):

- Meters should be stored away from high traffic areas in order to minimize damage risk.
- Meters must not be stacked.
- If meters will be stored in humid or corrosive areas, the flange faces may need to be coated with a suitable rust preventative appropriate for outdoor exposure. Note that any coating or sealant may need to be removed prior to installation; refer to the specification and applicable standards or codes.
- The ends are capped to eliminate foreign matter from damaging the internal portions of the meter. These caps must not be removed until installation.
- The pressure sensing tap connections have pipe plugs to eliminate the possibility of clogging. These caps must not be removed until installation.
- If the exterior finish gets damaged, it must be touched-up with the same or a compatible coating system. Note that prolonged exposure to sunlight may discolor, de-gloss, or chalk exterior finish.
- It is recommended that the meters be covered with a tarp or heavy plastic sheeting.

Long-Term Storage :

- Long-term storage requires indoor storage where temperature and humidity fluctuations are minimized. Otherwise, contact PFS.

Meter Transport:

- Depending on unit and order size, the venturi meters are strapped or lagged onto pallets or custom skids.
- Using the skids, the meters can be moved by a forklift of adequate capacity. DO NOT DRIVE THE FORK THROUGH THE FLANGE CAPS OR INTO THE METER INTERIOR.
- The meters can be lifted by a crane or forklift in conjunction with an appropriate sling.
- Avoid scraping or scratching the coated surfaces. Touch-up coatings as needed.

PFS
Primary Flow Signal

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Cranston, RI 02910
Ph. 877-737-3569
Fax 401-461-4450

Safety

Prior to Start-Up:

Determine that the meter is properly installed. The venturi meter is a piping component and should be handled accordingly with the same precautions.DO NOT HANDLE METER FROM ITS INSIDE.

Determine that the pressure connections are properly made and are appropriate for the intended service.

Determine that meter has been installed in strict conformance with the “Installation Directions” included in this manual.

If the meter appears damaged in any way, contact the local PFS Sales Representative or service organization, or contact Primary Flow Signal, Inc. directly.

At Start-Up:

Do not over-pressurize the meter. Refer to approval drawing for design pressure.

Do not subject meter to shock pressures or water hammer.

When filling pipe line, bleed-off air in the proper fashion.

After Start-Up:

Do not over-pressurize the meter. Refer to approval drawing for design pressure.

Do not subject meter to shock pressures or water hammer.

Conform to “Preventive Maintenance” procedures included in this manual.

Primary Flow Signal

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Cranston, RI 02910
Ph. 877-737-3569
Fax 401-461-4450

DEZURIK MOTORIZED BUTTERFLY VALVE SUBMITTAL

NORTHPORT WTP – FILTER & SCADA IMP.
NORTHPORT, ALABAMA

ENGINEER
Krebs Engineering, Inc.
2100 River Haven Drive, Suite 100
Birmingham, AL 35244

OWNER
City of Northport
3500 McFarland Boulevard
Northport, AL 35476

VENDOR
Eco-Tech, Inc.
156 Hickory Springs Industrial Drive
Canton, Georgia 30115

Original: September 22, 2022
Revision #1: October 4, 2022

Northport WTP – Filter & SCADA Improvements
Northport, Alabama

Description: DeZurik Motorized Valves

Supplier:
Eco-Tech, Inc.
156 Hickory Springs Industrial Drive
Canton, GA 30115
Ph: (770) 345-2118
Contact: Heather Bame
Email: hbame@eco-tech.net

Manufacturers:
DeZurik/APCO/Hilton
250 Riverside Avenue North
Sartell, MN 56377
Ph: 320-259-2000
Website: www.dezurik.com

Service Center:
Eco-Tech, Inc.
156 Hickory Springs Industrial Drive
Canton, GA 30115
Ph: (770) 345-2118
Contact: Kelsie Gibson
Email: kgibson@eco-tech.net

ECO-TECH, INC.
156 Hickory Springs
Industrial Drive
Canton, GA 30115
Phone: 770-345-2118
Fax: 770-345-2699

Northport WTP – Filter R.O.F. Controller Imp.

Response to Engineer's Comments dated September 29, 2022

Venturi R.O.F. Controller and Butterfly Valves – Submittal #1

1. Manufacturer shall confirm operation of 8-inch valve/actuators with existing venturi meters within the specified flow range.	Confirmed.
2. Manufacturer shall confirm the provision of start-up and training as specified.	Confirmed.
3. Manufacturer shall confirm the warranty for the operation of filters no. 1-6.	Confirmed.
4. Manufacturer shall confirm actuator is rated for modulating operation.	Confirmed.
5. Supplier shall confirm the supply of 6 butterfly valves, not 8.	Confirmed.
6. See electrical comments attached.	Acknowledged.
Electrical Review Comments	
E1. These submittals do not clearly indicate the specific I/O provisions for the proposed valve actuators. These valves actuators shall be provided with the following I/O (for SCADA control/monitoring) per contract documents: a) 4-20mA analog input for position control b) 4-20mA analog output for position feedback c) Dry contact discrete output (rated for up to 120VAC) for "HOA Not In Auto" indication d) Dry contact discrete output (rated for up to 120VAC) for "General Alarm" indication	Confirmed. Rotork actuators have 4-20mA input and outputs and enough configurable dry contacts for the required indications.

Submittal Data Sheet

Date: 09/22/2022

CITY OF NORTHPORT
PO BOX 569
NORTHPORT, AL 35476

P.O 22094AL-16

FACTORY ORDER NO: STOCK

PROJ. NORTHPORT, AL - FILTER ROFC

Fact. ITEM	Cust. ITEM	QTY	DESCRIPTION
1	1	6	BAW,8,F1,CI,NBRN-NBR,150B,DI-S2*X

Style	BAW	DeZURIK AWWA C504 3-72"; C516 78" and larger Rubber Seated Butterfly Valve
Size	8	8 Inch (200mm)
End Connection	F1	Flanged, Drilled to ASME B16.1 Class 125/150
Body Material	CI	Cast Iron, ASTM A126 Class B
Packing	NBRN	NBR (Acrylonitrile-Butadiene), Self-Adjusting Multiple V-Ring; -20 to 180°F (-29 to 82°C)
Seat Material	NBR	NBR (Acrylonitrile-Butadiene); -20 to 180°F (-29 to 82°C)
Service Class	150B	AWWA Class 150B
Disc	DI	Ductile Iron, ASTM A536 Grade 65-45-12 (3" - 24" (80-600mm) Class 150B/250B, 28" - 72" (700-1800mm) Class 25A, 75B & 150B & 28" - 48" (800-1200mm) Class 250B) and Grade 80-55-06 (54" - 72" (1400-1800mm) Class 250B), Type 316 Stainless Steel Seating Edge (3" - 20" (80-500mm) =ASTM A276, 24" and larger (600mm & larger) - ASTM A240)
Shaft	S2	316 Stainless Steel, ASTM A276
Coating or Paint	S30SC0	8 mils minimum (non-stainless steel parts) of Blue DeZURIK Epoxy (NSF Std. 61) on Interior and Standard (SP10) surface prep AND Blue DeZURIK Epoxy (NSF Std. 61), and on Exterior with Standard (SP10) surface prep
Actuator Type	X	Rotork IQTM500 Electric Motor Operator

RELATED DOCUMENTS

J63487	DWG INST BAW F1 IQT
A47532	DWG INST VALVE BAW F1 3-20"
A47525	DWG VALVE ASSY BAW F 3-12"

FEATURES

Tag: BV1

IQT Electric Motor Actuator Data Sheet

Job Number	**2R1488**	Line:	**1**		
Contract Eng.:				Date:	9/22/2022
Project:	Northport, AL - Filter ROFC				
Consultant:					
MOV Tag No.'s:					
Shop Drawing:	R13167				

CUSTOMER DATA

Name:	ECO-TECH
P.O. No.:	22094AL-113
P.O. Item:	1
Cust. Part Number:	

VALVE DATA

Make:	
Size:	
Type:	
Class:	

ACTUATOR DATA

Model No.:	IQTM500FA101	Handwheel:	Standard Handwheel
Base:	FA10	Paint Spec.:	Polyester Powder Coating
Actuator Weight:	44 lbs	Conduit 1:	ASA 0.75"
Enclosure:	NEMA 4/6	Conduit 2:	ASA 0.75"
Rated Torque:	369 lbft	Conduit 3:	None
Wiring Diagram:	403B0000	Conduit 4:	None
Operating Time:	60 sec	Lubrication:	STD
		Operating Temp.:	0 C

MOTOR DATA

Rated Load Amps:	0.9 A	Insulation Class/Duty:	F / 15 min.
Nominal Load Amps:	0.9 A	Service Factor	1
Nom. Motor HP:	0.58	Type:	Totally Enclosed Non-Ventilated
Supply V/Ph/Hz:	480V / 3Ph / 60Hz		

VALVE SIZE	DIMENSIONS INCHES / MILLIMETERS										
	A	B	C	D	E	F	G	H	J	K	L
6	5.00 / 127	1.06 / 27	6.03 / 153	7.00 / 178	9.50 / 241	.88 / 22	4	3/4–10 UNC	4	1.28 / 33	11.00 / 279
8	6.00 / 152	1.19 / 30	7.16 / 182	8.31 / 211	11.75 / 298	.88 / 22	8	N/A	N/A	N/A	13.50 / 343

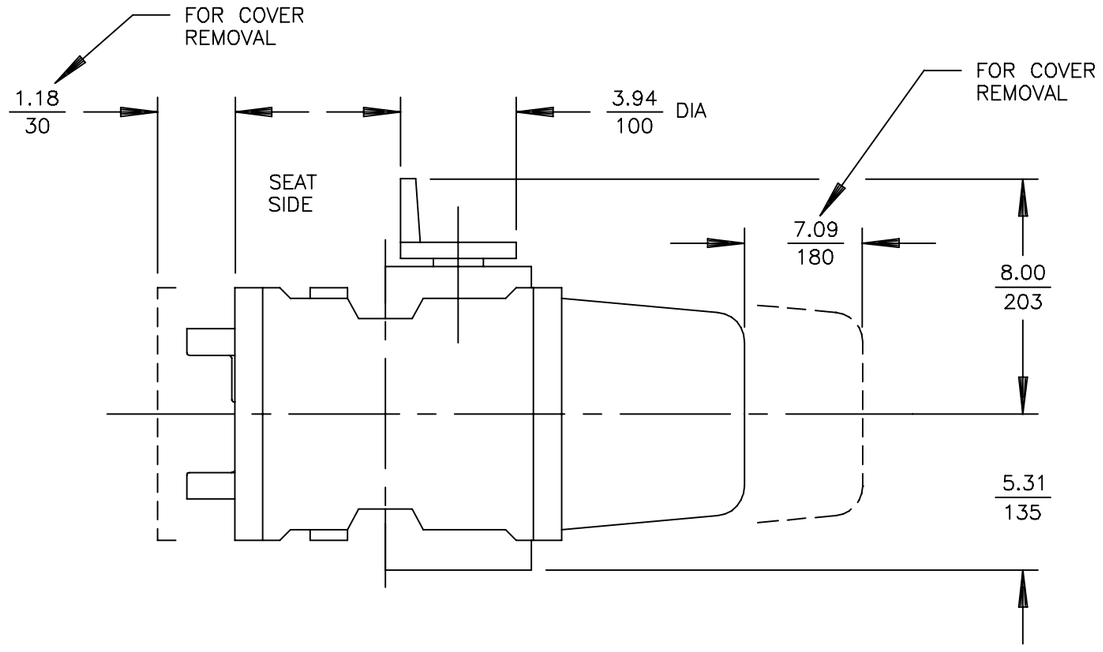
A	VALVE
C	MOTOR
P	CONNECTING PARTS

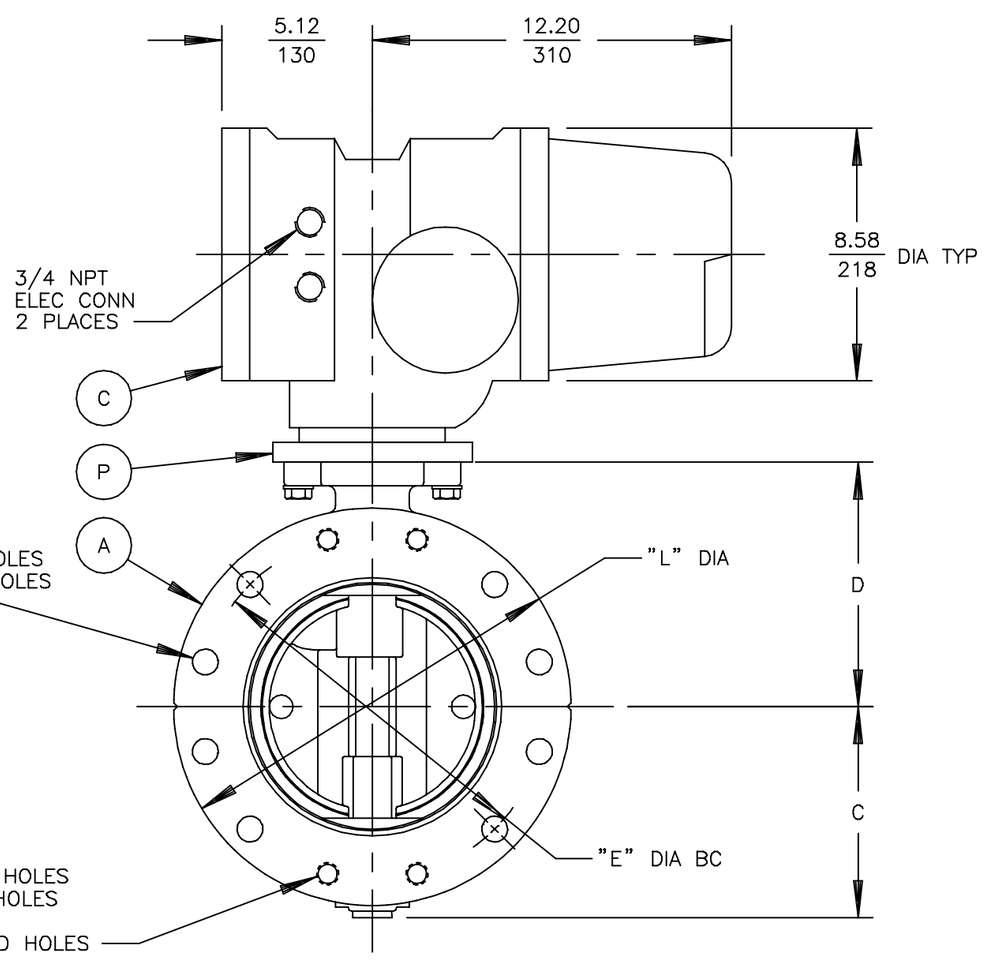
NOTE:

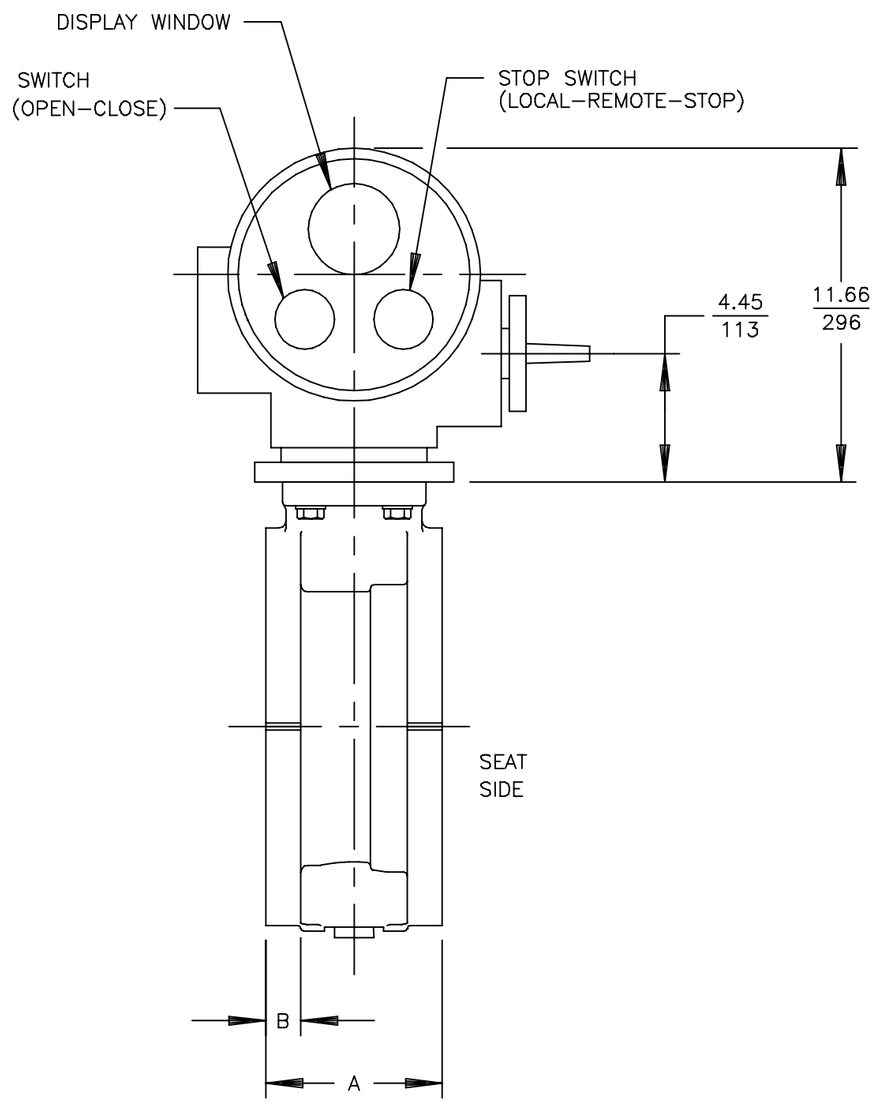
1. FLANGES ARE FLAT FACED WITH DIMENSIONS AND DRILLING TO ANSI B16.1 CLASS 125 EXCEPT FOR TAPPED HOLES AS INDICATED. SEE A–26506 FOR NON–ANSI FLANGE DATA.
2. FLOW MAY BE IN EITHER DIRECTION. THE PREFERRED INSTALLATION IS WITH THE SEAT SIDE DOWN STREAM.
3. PULL OUT LEVER TO ENGAGE FOR MANUAL OPERATION. UNIT REMAINS IN HAND OPERATION UNTIL MOTOR IS ENERGIZED.
4. MOTOR ACTUATOR MAY BE MOUNTED IN INCRUMENTS OF 90°

NOTICE

THIS DRAWING DOES NOT SHOW ACTUATOR ACCESSORIES. IF ACCESSORIES ARE REQUIRED, REFER TO THE APPROPRIATE ACCESSORY INSTALLATION DRAWING FOR DIMENSIONS AND OTHER RELATED INFORMATION.







G	F	E	D 09/17/07	C 03/29/05	B 03/24/04	A 03/08/04
			61336	50312	50312	50312

DeZURIK
Sartell, MN USA 56377
www.dezurik.com

AWWA BUTTERFLY VALVES SIZE 6–8 FLANGED
ROTORK IQT 125, 250 & 500 MOTOR ACTUATORS

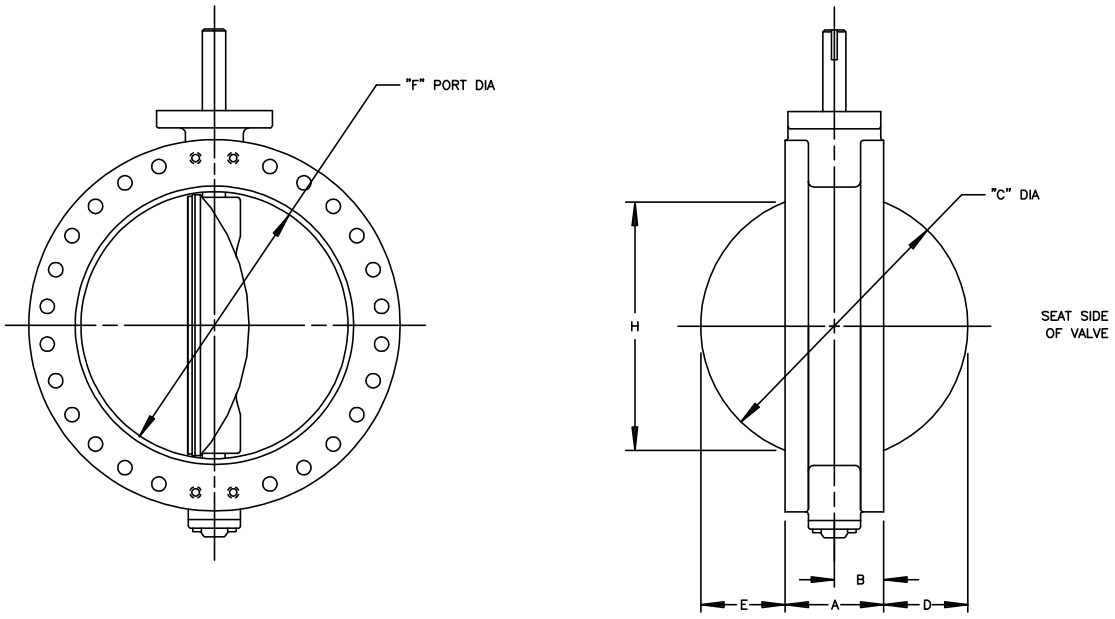
DOCT. CODE	DRAWN	APPROVED	
C1	BMP	GAP	J63487
	CHECKED GAP	DATE 11/17/03	

VALVE SIZE		VALVE CLASS	DIMENSIONS INCHES / MILLIMETERS						
INCH	MM		A	B	C	D	E	F	H
3	80	150B 250B	5.00 127	2.50 64	3.00 76	NONE	NONE	2.88 73	NONE
4	100	150B 250B	5.00 127	2.50 64	4.00 102	NONE	NONE	3.88 99	NONE
6	150	150B 250B	5.00 127	2.50 64	5.75 146	.375 9.5	.375 9.5	5.62 143	2.88 73
8	200	150B 250B	6.00 152	3.00 76	7.60 193	.80 20	.80 20	7.47 190	4.72 120
10	250	150B 250B	8.00 203	4.00 102	9.62 244	.81 21	.81 21	9.46 240	5.40 137
12	300	150B 250B	8.00 203	4.00 102	11.60 295	1.80 46	1.80 46	11.45 291	8.46 215
14	350	150B 250B	8.00 203	4.00 102	13.60 345	2.80 71	2.80 71	13.40 340	11.06 281
16	400	150B 250B	8.00 203	4.00 102	15.50 394	3.74 95	3.74 95	15.25 387	13.32 338
18	450	150B 250B	8.00 203	4.00 102	17.25 438	4.61 117	4.61 117	17.00 432	15.34 390
20	500	150B	8.00 203	4.00 102	19.25 489	5.61 142	5.61 142	19.00 483	17.56 446
20	500	250B	8.00 203	4.00 102	19.06 484	5.51 140	5.51 140	19.00 483	17.56 446

SIZE	"G" (VALVE WEIGHT)									
	3	4	6	8	10	12	14	16	18	20
150B	33	45	65	100	156	250	325	470	505	675

NOTE:

1. "G" IS BARE SHAFTED VALVE WEIGHT (LBS).



G	F	E	D	C	B	A	
	50312	50312	61159	50312	60713	50312	
	11/22/16	09/24/08	02/13/04	09/11/02	02/20/02	02/07/97	

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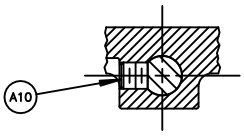
www.dezurik.com

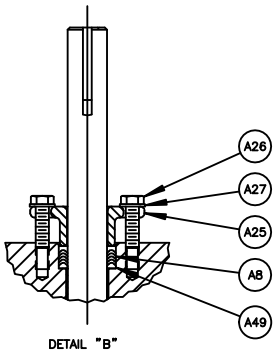
3–20 FLANGED AWWA BUTTERFLY VALVES
SHOWING DISC CLEARANCE IN FULL OPEN POSITION,
VALVE WEIGHTS AND PORT DIAMETER

DOCT. CODE	DRAWN	APPROVED
C1	KW	WCB
	CHECKED	DATE
	SJJ	09/17/96

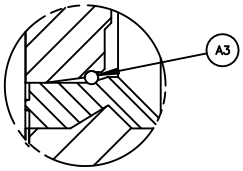
A47532



SECTION A–A



DETAIL "B"
ADJUSTABLE PACKING
(OPTIONAL)



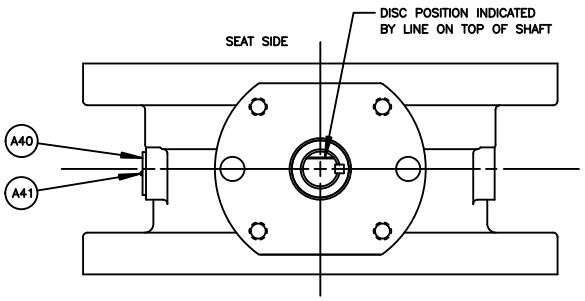
ENLARGED
DETAIL "C"

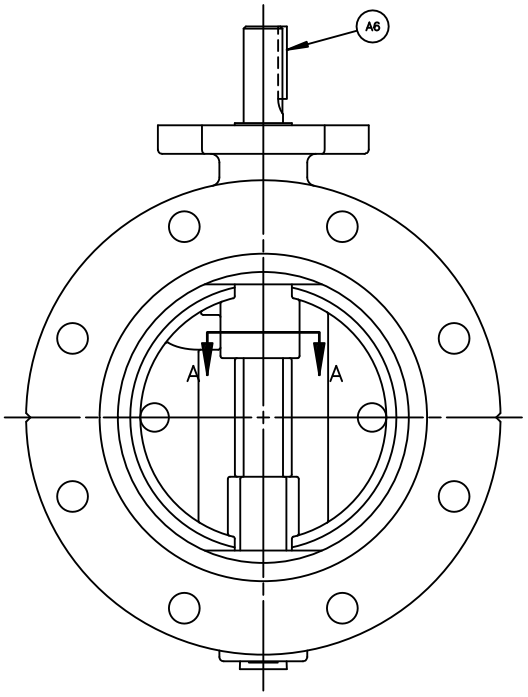
NO	PART NAME	QTY
A1	BODY	1
A2	DISC	1
A3	SEAT RING	1
A4		
A5	SHAFT	1
A6	KEY	1
A7	BEARING (UPPER JOURNAL)	1
A8	PACKING	–
A9		
A10	TORQUE PLUG	1
A11		
A12		
A13		
A14		
A15		
A16	PLUG	1
A25	GLAND	1
A26	SCREW	2
A27	WASHER	2
A32	BEARING (LOWER JOURNAL)	1
A40	VALVE CLASSIFICATION PLATE (WHEN REQ'D)	1
A41	DRIVE SCREW (USED WITH A40)	2
A49	SUPPORT RING (PTFE PACKING ONLY)	1

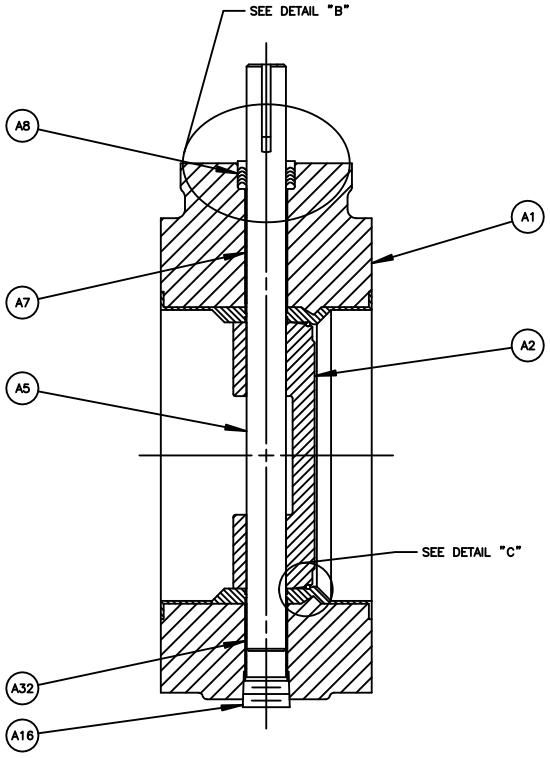
NOTE:

1. WHEN ORDERING PARTS, INCLUDE VALVE SIZE AND PART NUMBER FROM DATA PLATE. ALSO INCLUDE THIS DRAWING NUMBER WITH PART NAME, NUMBER AND QUANTITY.

2. REPLACEABLE WEAR PARTS ARE ITEMS NO A7, A8 AND A32.







G	F	E	D	C	B	A	
71280	61892	62135	61364	61156	60712		
09/14/22	01/17/14	12/14/12	07/14/08	02/13/04	02/20/02		

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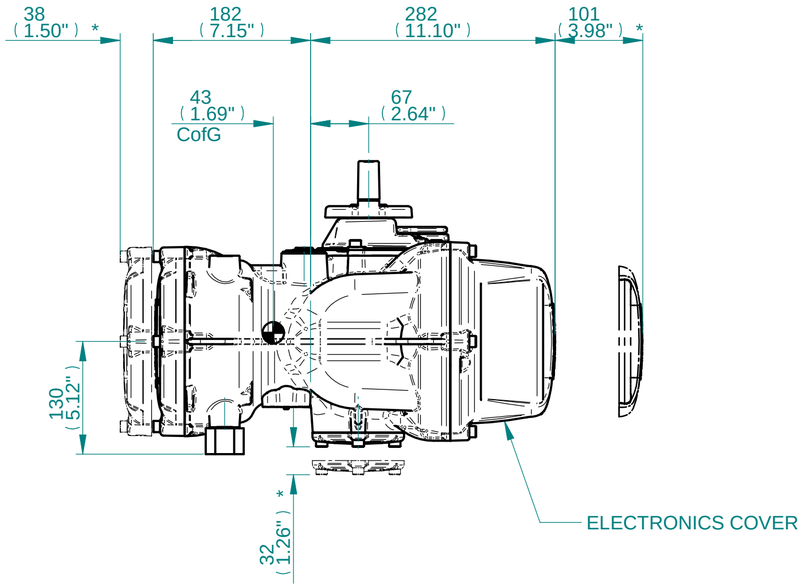
BAW BUTTERFLY VALVES SIZE 3 – 12
FLANGED VALVE ASSEMBLY

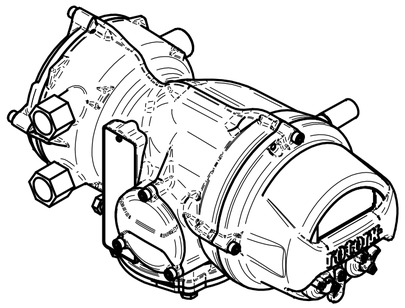
DOCT. CODE	DRAWN	APPROVED	A47525
C1	KW	WCB	
	CHECKED	DATE	
	SJJ	09/11/96	

MATERIALS OF CONSTRUCTION

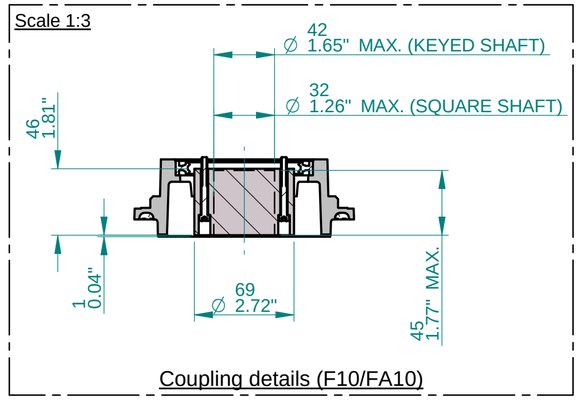
DRAWING(S): A47525 , A47525
DESCRIPTION: BAW,8,F1,CI,NBRN-NBR,150B,DI-S2*X

Item	Material
A01	IRON, ASTM A126, CLASS B
A02	DUCTILE IRON, ASTM A536, GRADE 65-45-12
A05	STAINLESS STEEL, TYPE 316, ASTM A276, CONDITION A
A06	STEEL, COLD DRAWN, AISI 1018
A07	NYLON MOLYBDENUM DISULFITE
A08	ACRYLONITRILE-BUTADIENE (NBR)
A10	STAINLESS STEEL, TYPE 316
A16	STEEL CARBON, SAE J403, GRADE 1008 OR 1010
A32	NYLON MOLYBDENUM DISULFITE





ISOMETRIC VIEW



Coupling details (F10/FA10)

NOTES:

:DIMENSIONS WITH '*' INDICATE COVER REMOVAL ALLOWANCE

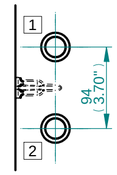
:NETT WEIGHT = 20kg/44lbs

: = CENTRE OF GRAVITY CO-ORDINATES

:THE INTERFACE PROVIDED FOR MOUNTING THE ACTUATOR OR SECOND STAGE GEARBOX ONTO THE VALVE SHOULD CONFORM TO GOOD ENGINEERING PRACTICES, ENSURING ADEQUATELY TOLERANCED LIMITS FOR PARALLELISM, PERPENDICULARITY AND CONCENTRICITY.

:ROTORK CANNOT BE HELD LIABLE FOR DAMAGE TO OUR EQUIPMENT CAUSED BY EXCESSIVE LOADING FROM COVER TUBES. (SEE ALSO E156E)

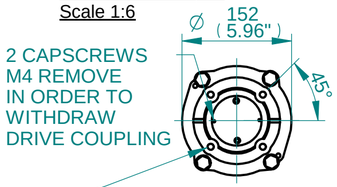
CONDUIT ENTRIES



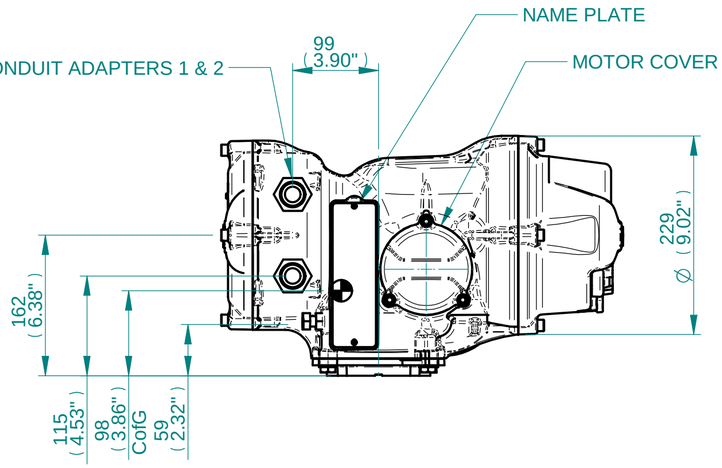
	Hole 1	Hole 2
Size	3/4"NPT	3/4"NPT
Plugged	3/4"NPT	3/4"NPT
Gland	No Gland	No Gland

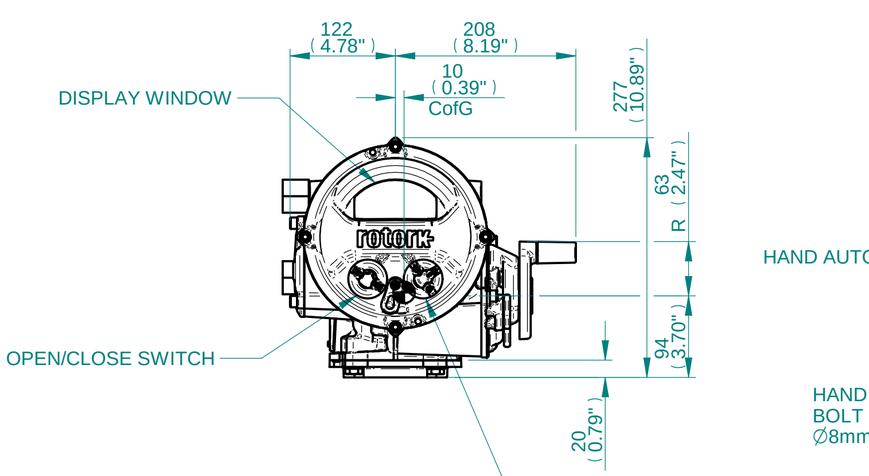
View on Arrow 'A'

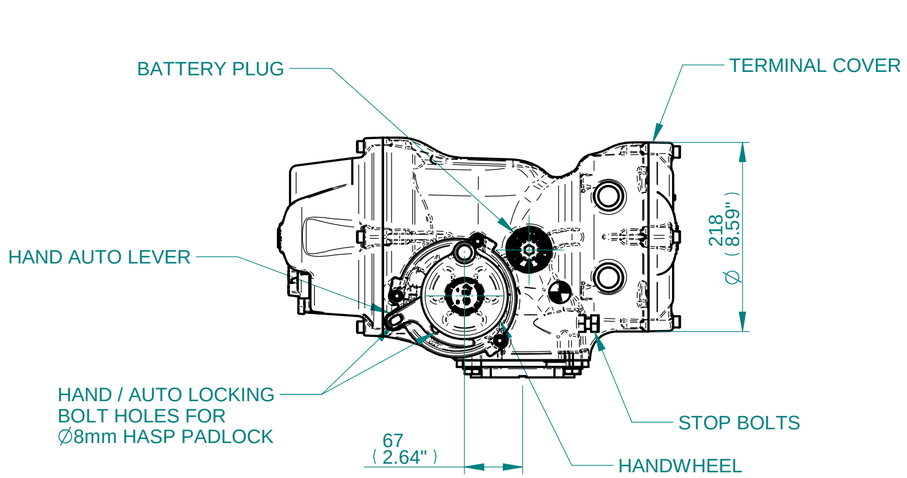
Scale 1:6



FA10 BASE DETAILS







rotork
www.rotork.com
Rotork Controls, Inc.
Rochester, NY 14624
Telephone 585-247-2304
Telefax 585-247-2308

Title IQTM500-FA10.1,WT, Installation Details

Drawn WMH Checked RAR Date

Ref STD Project Ref NORTHPORT FILTER ROFC

CERTIFIED DATA

Customer			Rated Torque	Elec. Supply
ECO-TECH, INC.			369lbsft/500Nm	480-3-60
Order No	Enclosure		Nominal HP	Wiring Diagram
22094AL-113	IP68		0.58hp	403B0000
Item No	Op.Time/Speed	Nett Weight	Average Load	Paint
1	60 secs	20kg/44lbs	0.9amps	00-A-05

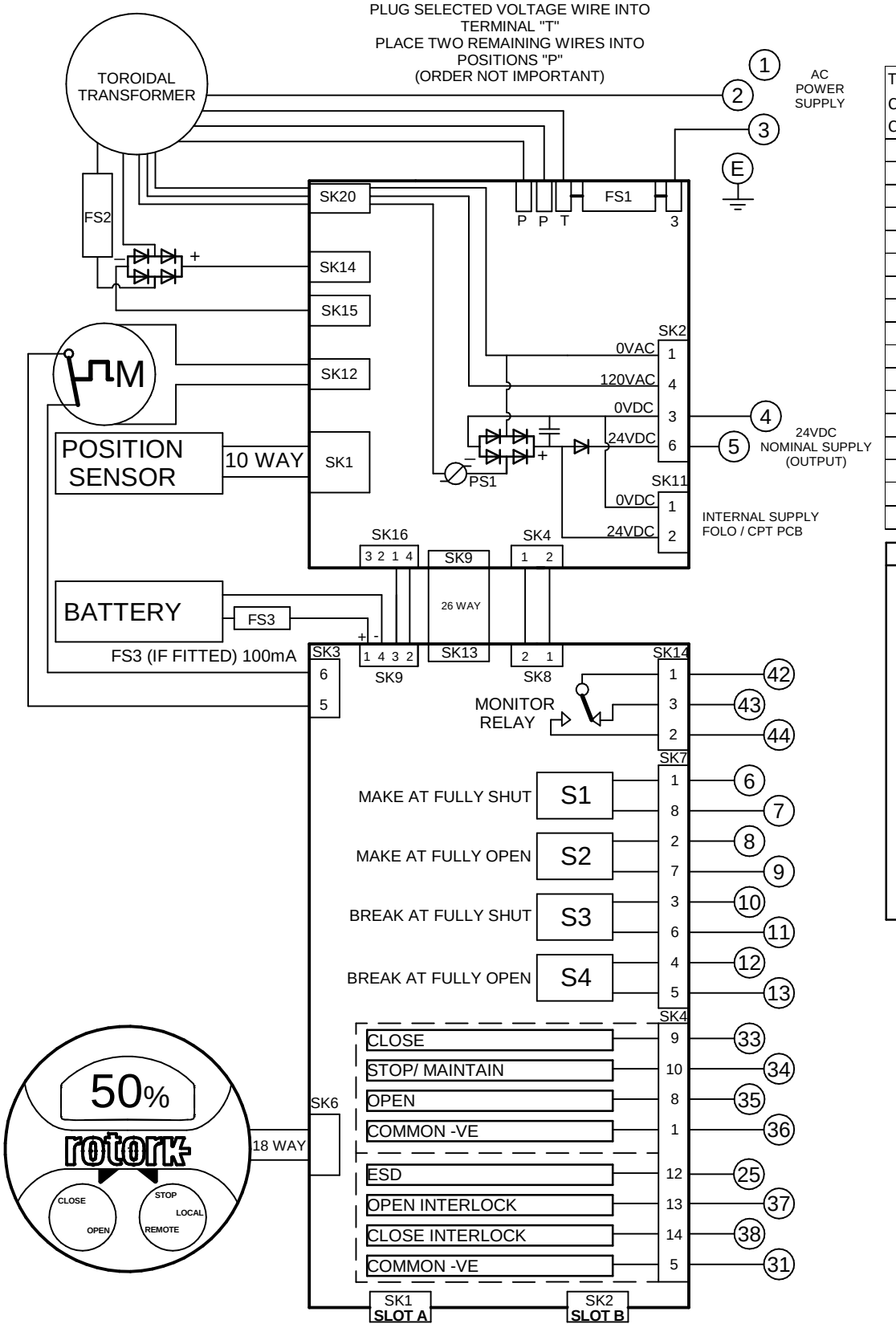
Issue	Description
1	First Issue

Scale: 1:5 THIRD ANGLE PROJECTION

A2	Drawing Number	Issue No	Sheet No
	2R148801	1	1 of 1

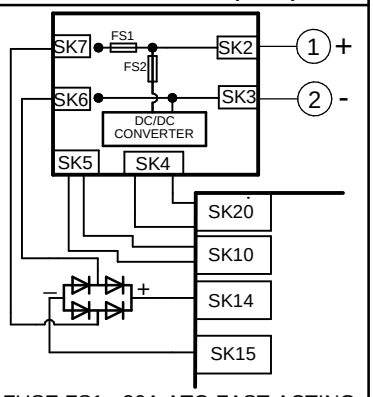
CIRCUIT DRAWN WITH POWER SUPPLY OFF

FOR TYPICAL REMOTE CONTROL DETAILS, SEE DOCUMENT
RWS102



TRANSFORMER VOLTAGE OPTIONS: CONNECT CORRESPONDING COLOUR TO "T"		
TYPE 1		
GREY	100V	FS1 - 5A ANTISURGE
PURPLE	110V	
BROWN	120V	
TYPE 2		
GREY	200V	FS1 - 2.5A ANTISURGE
PURPLE	230V	
BROWN	270V	
TYPE 3		
GREY	380V	FS1 - 2.0A ANTISURGE
PURPLE	400V	
BROWN	415V	
TYPE 4		
GREY	480V	FS1 - 2.0A ANTISURGE
PURPLE	575V	
BROWN	690V	
FS2 - 20A ATO FAST ACTING ALL TYPES		

TYPE 5 DC (ONLY)



FUSE FS1 - 20A ATO FAST ACTING
FUSE FS2 - 500mA ANTI-SURGE

REFER TO SHEET 2 FOR NOTES & OPTION PCB'S IF FITTED

Iss	Date	Chkd	Revision Details
3	220515	JJB	Power Supply for folo was from SK14.
4	261115	PMJ	TYPE 5 DC WIRING UPDATED.
5	130616	PW	Updated notes on page 2.
6	040719	PMJ	PUB002-065 WAS -039
7	290920	JC1	Fuses type 3 & 4 corrected

www.rotork.com

ROTORK CONTROLS LTD
BATH, BA1 3JQ
ENGLAND
Tel:01225-733200

ROTORK CONTROLS INC
ROCHESTER
NY 14624, USA
Tel:585-247-2304

IQTM + FOLOMATIC + CPT

Drawn by: PMJ
Date : 170614
Base WD: 403B0000
Job No : - -
MI No : - -

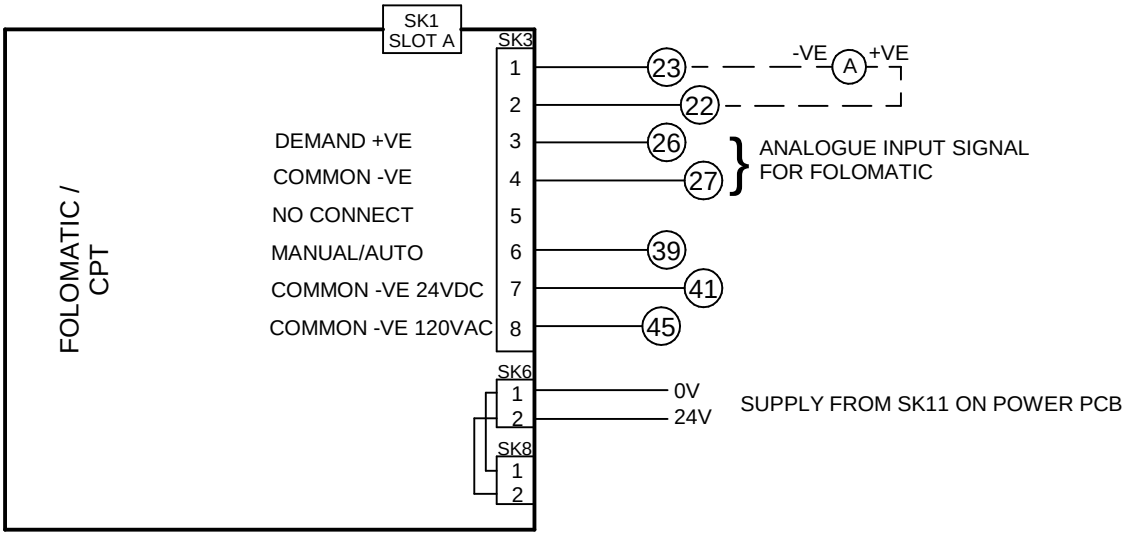
Circuit Diagram Number
403B0000
B1 C1 B2 C2

Issue No 7

Sheet 1 of 2

CIRCUIT DRAWN WITH POWER SUPPLY OFF

SLOT A



FOR MANUAL/AUTO CONNECTIONS AND
DETAILS OF FOLOMATIC/CPT FUNCTIONS
REFER TO ROTORK PUBLICATION PUB002-041

NOTES

1.FUSES:
-PS1 is a self-resetting fuse.
-Refer to publication PUB002-065 for approved fuses FS1 and FS2.
-Actuator rated voltage specified on nameplate. Voltage tolerance +/-10%, applies for rated torque performance; duty cycle is not guaranteed.

2.REMOTE CONTROL:
-For typical remote control circuits refer to:
  -RWS indicated or PUB002-041.
-For DC control connect –ve to terminal 36.
-(For negative switch / positive common, refer to RWS indicated).
-Control signal threshold voltages:
  -DC: “on” ≥16Vdc / “off” ≤8Vdc, max 60Vdc.
-Control signal duration to be 100ms minimum.
-Maximum current drawn from remote control signals is:
  -8mA at 24Vdc.
-Supply provided on terminals 4 & 5:
  -Intended for remote control.
  -Max external load 5W at 24Vdc

3.INDICATION:
-For typical position, status and alarm indication see PUB002-041.
-“S” contacts are user configurable and are shown in their default setting.
-Refer to PUB002-040 for functions and configuration instructions.
-Monitor Relay indicates actuator availability for remote control (shown “unavailable”). It can be configured to exclude local/remote selection.
-Refer to PUB002-040 for monitored functions and configuration instructions.
-Voltage applied to indication contacts must not exceed 150Vac
-Individual Switch current must not exceed 3.5A inductive, 5A resistive and no more than 8A in total for all 4 contacts.

4.BATTERY:
-Battery maintains local and remote “S” contact indication only.
-Refer to installation manual for approved replacement battery types.

See Sheet 1 for all Revision details/information

Circuit Diagram Number	Issue No	Sheet
403B0000	7	2 of 2

Document Title: STANDARD IQ REMOTE CONTROL CIRCUITRY + FOLOMATIC (24VDC)

THE BLUETOOTH® SETTING TOOL ENABLES ALL CONFIGURABLE ACTUATOR SETTINGS TO BE MADE.

BEFORE PUTTING THE ACTUATOR INTO SERVICE, IT MUST BE INSTALLED AND COMMISSIONED IN ACCORDANCE WITH PUBLICATION PUB002-039 INSTALLATION AND MAINTENANCE INSTRUCTIONS.
UNLESS SPECIFIED WITH ORDER, THE ACTUATOR IS DESPATCHED WITH DEFAULT SETTINGS AS LISTED IN PUBLICATION PUB002-040.

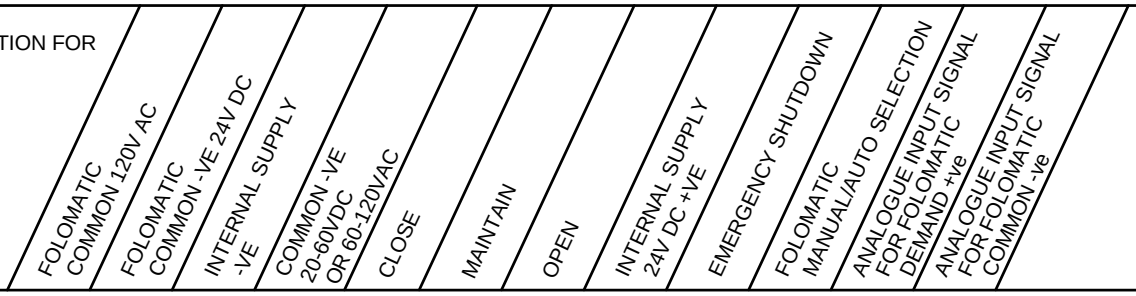
FOR IQ CONTROL AND MONITORING FACILITIES, REFER TO PUBLICATION PUB002-041.

NOTE:
ACTUATOR REMOTE CONTROL SIGNALS MAY BE INTERNALLY OR EXTERNALLY SUPPLIED.

INTERNALLY SUPPLIED:
FIT LINK '#' AS SHOWN AND CONNECT REMOTE CONTROL CONTACTS TO INTERNAL SUPPLY ON TERMINAL 5.

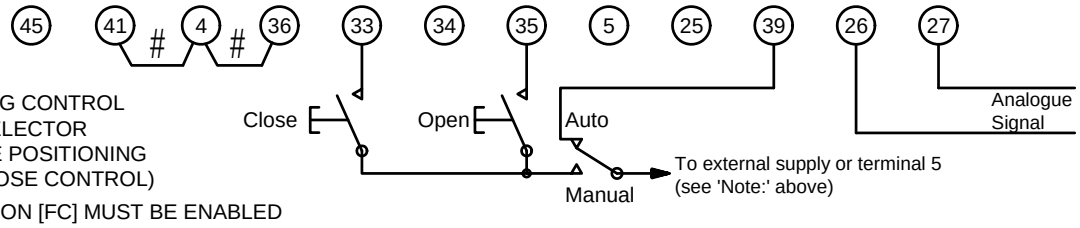
EXTERNALLY SUPPLIED:
CONNECT CONTROL CONTACTS TO EXTERNAL SUPPLY LIVE/+VE.
CONNECT SUPPLY ZERO/-VE AS FOLLOWS:-
TO TERMINAL 41,36 & 31 FOR SUPPLIES 20-60VDC OR 60-120VAC
TO TERMINAL 45 FOR FOLOMATIC SUPPLIES UP TO 120VAC

CUSTOMER CONNECTION FOR REMOTE CONTROL



FOLOMATIC

ANALOGUE POSITIONING CONTROL ONLY



FOLOMATIC

ANALOGUE POSITIONING CONTROL WITH MANUAL/AUTO SELECTOR (PROVIDING ANALOGUE POSITIONING CONTROL OR OPEN/CLOSE CONTROL)

MANUAL/AUTO SELECTION [FC] MUST BE ENABLED
REFER TO PUB002-038 FOR DETAILS

FORM F

EMERGENCY SHUT-DOWN CIRCUIT.
THE ESD CIRCUIT CAN BE ADDED TO ANY OF THE CONTROL CIRCUITS SHOWN ABOVE.
AN ESD SIGNAL APPLIED TO THE ACTUATOR WILL OVERRIDE ANY EXISTING OPEN OR CLOSE CONTROL SIGNAL.
THE DEFAULT ESD CONFIGURATION IS "STAY PUT", & MUST BE DERIVED FROM A N/O CONTACT (SIGNAL APPLIED).
FOR OTHER CONFIGURABLE ESD SETTING OPTIONS, REFER TO PUBLICATION PUB002-040 INSTALLATION AND MAINTENANCE INSTRUCTIONS.

DeZURIK

RECOMMENDED LONG & SHORT TERM STORAGE PROCEDURES

LONG TERM STORAGE (6 MONTHS +)

1. All valves shall be stored in the position in which they were shipped.

2. Valves shall be stored fully enclosed in a crate or on a skid. It is acceptable to store the valves uncrated but protected from any dirt, debris or UV exposure as long as the environmental conditions as described in item 3 are met. Any desiccant packages received with the original shipment should be replaced before putting valves into long term storage. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.

3. Valves shall be stored in a well ventilated, clean, dry indoor facility on skids or raised racks with temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.

4. If the above conditions cannot be met, valves shall be separately packaged inside sealed heavy duty plastic sheeting and a weather resistant enclosure, or a standard crate lined with moisture proof paper, to protect the valves from dirt, debris and UV exposure. Desiccant packages shall be used to control moisture both inside the enclosure and the sealed heavy duty plastic covering. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.

5. Do not store valves next to operating electric motors or equipment which may emit ozone, which can cause deterioration of valve elastomers. Store in an environment with less than 0.1 ppm concentration, at least 25 feet from ozone emitting devices, with ventilation.

6. Valves with cylinder actuators and control valves which are stored for extended periods may be subject to cylinder blow-by caused by permanent distortion of any of the seals. Valves should be operated prior to installation and damaged seals replaced. If possible, it is recommended that cylinders be cycled every 4-6 months to maintain seals.

7. Valves with electric motor operators shall be stored in accordance with the individual motor manufacturer's recommended long term storage procedures.

8. All electrical components shall be visually inspected prior to valve installation.

SHORT TERM STORAGE (LESS THAN 6 MONTHS)

1. All valves shall be stored in the position in which they were shipped.

2. Valves shall be protected from dirt, debris, excessive moisture and UV exposure. Store at temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.

CITY OF NORTHPORT
UTILITIES

WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. 1

NORTHPORT, ALABAMA

PROJECT NO. 21014

KREBS ENGINEERING

KREBS ENGINEERING

ALABAMA LICENSED No. 25751 PROFESSIONAL ENGINEER JACK L. ALLEN 3/15/23

JOB NO. 21014

CITY OF NORTHPORT UTILITIES
WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I
NORTHPORT, ALABAMA

Designed	MKM
Drawn	NTS/MKM/JAD
Checked	CLL/JAD
Project No.	21014

Revisions

No.	Date	Description

Sheet Title: COVER SHEET

Issue Date	Sheet No.
MAR., 2023	G0-01
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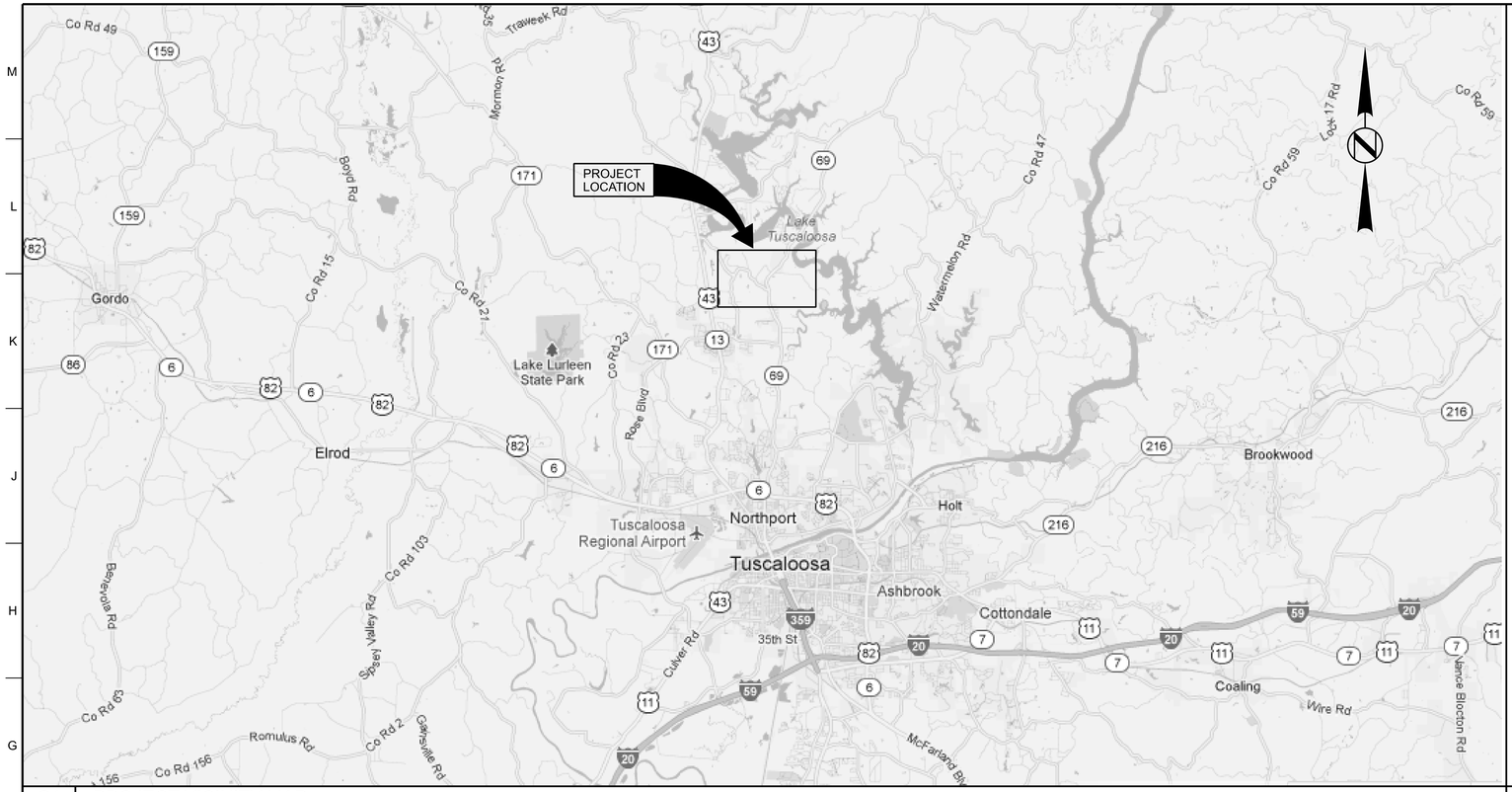
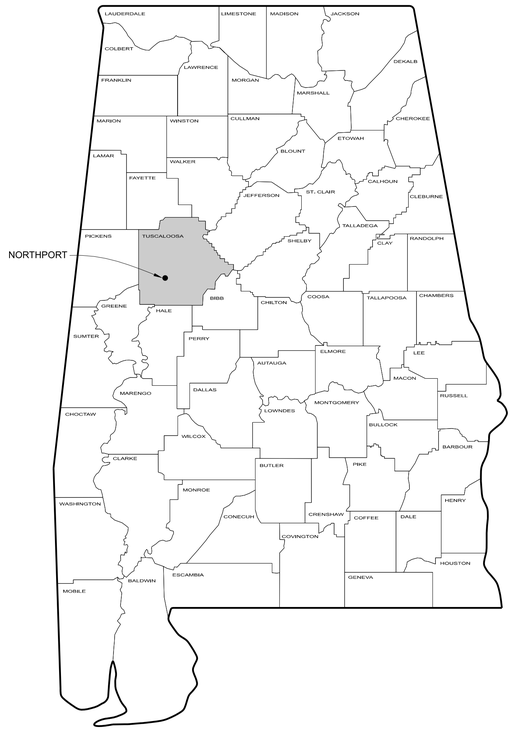
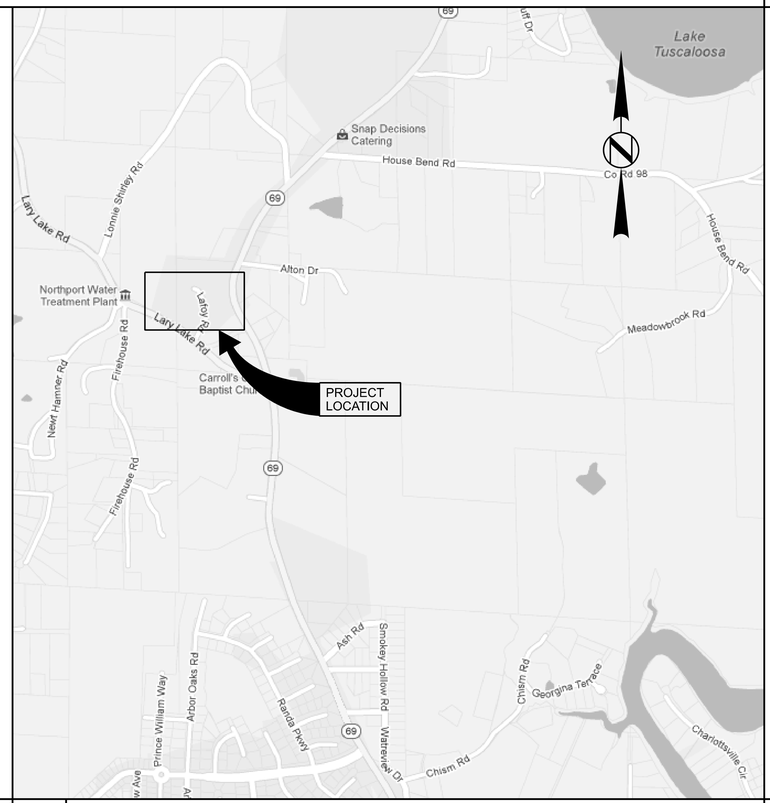


G1 | PROJECT VICINITY MAP | NO SCALE



A1 | STATE LOCATOR | NO SCALE



A6 | PROJECT LOCATION MAP | NO SCALE

SEQ. NO.	SHEET NO.	SHEET TITLE
1	G0-01	COVER SHEET
2	G0-02	LOCATION MAP & SHEET INDEX
3	G0-03	STANDARD SYMBOLS & ABBREVIATIONS
4	C0-01	OVERALL EXISTING FILTER BUILDING LOWER PLAN
5	C1-01	FILTERS 1-3 GALLERY DEMOLITION PLANS & SECTION
6	C1-02	OVERALL EXISTING FILTER BUILDING UPPER PLAN
7	C1-03	FILTERS 4-6 GALLERY DEMOLITION PLANS & SECTION
8	E0-01	ELECTRICAL LEGEND & NOTES
9	E0-02	DIAGRAM & SCHEDULE
10	E1-01	OPERATING FLOOR ELECTRICAL PLAN
11	E1-02	FILTERS 1-3 GALLERY ELECTRICAL PLAN
12	E1-03	FILTERS 4-6 GALLERY ELECTRICAL PLAN
13	E2-01	ELECTRICAL DETAILS

G11 | SHEET INDEX | NO SCALE

A11 | GENERAL NOTES | NO SCALE

KREBS ENGINEERING

ALABAMA LICENSED PROFESSIONAL ENGINEER No. 25751 JACK A. ALLEN 3/15/23

JOB No. 21014

CITY OF NORTHPORT UTILITIES
WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I
NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

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Revisions

No.	Date	Description

Sheet Title: LOCATION MAP & SHEET INDEX

Issue Date: MAR., 2023 | Sheet No.: G0-02

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@	AT
&	AND
#	NUMBER
AC.	ACRE
ACQ'D	ACQUIRED
ADJ	ADJUSTABLE
ALDOT	ALABAMA DEPARTMENT OF TRANSPORTATION
ALT	ALTERNATE
ALUM.	ALUMINUM
APPROX.	APPROXIMATE
ARV	AIR RELEASE VALVE
ASPH.	ASPHALT
ASSY	ASSEMBLY
AVE	AVENUE
AVG	AVERAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
BFV	BUTTERFLY VALVE
BLDG.	BUILDING
BLK	BLOCK
BM	BENCH MARK
BOC	BACK OF CURB
BOT.	BOTTOM
BRKT.	BRACKET
BR. RES.	BRICK RESIDENCE
B.S.	BOTH SIDES
CB	CATCH BASIN
C.C.	CARRYING CAPACITY
C & G	CURB AND GUTTER
C.I.	CAST IRON
C.I.P.	CAST IRON PIPE
CIR	CIRCLE
℄	CENTER LINE
CONC.	CONCRETE
CONN.	CONNECTION
CONT.	CONTINUOUS
COR.	CORNER
CU. FT.	CUBIC FEET
CU. YD.	CUBIC YARD
CV	CHECK VALVE
CLR	CLEAR/CLEARANCE
C.M.P.	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COL	COLUMN
CTSK.	COUNTERSINK
CTV	CABLE TELEVISION
D.A.	DRAINAGE AREA
DBL	DOUBLE
D.F.	DESIGN FLOW
D.I.	DUCTILE IRON
D.I.P.	DUCTILE IRON PIPE
DIA.	DIAMETER
DIAG.	DIAGRAM
DIST.	DISTANCE
DET.	DETAIL
DN	DOWN
E	EAST
EA.	EACH
E.F.	EACH FACE
EFF. WTR.	EFFLUENT WATER
EL.	ELEVATION
EOP	EDGE OF PAVEMENT
EQ	EQUAL
ESMT.	EASEMENT
E.W.	EACH WAY
EX.	EXISTING
EXP.	EXPANSION
EXT.	EXTRUDED
FCA	FLANGED COUPLING ADAPTER
FD	FLOOR DRAIN
F.F.	FINISH FLOOR
FH	FIRE HYDRANT
FIG	FIGURE
FIN.	FINISH/FINISHED
FIN. GR.	FINISH GRADE
F.L.	FLOW LINE
FLG	FLANGED
FM	FORCE MAIN
FR. RES.	FRAME RESIDENCE
FT.	FOOT/FEET
G	GAS
GA.	GAUGE
GALV	GALVANIZED
GM	GAS METER
GPM	GALLONS PER MINUTE
GR.	GRADE
GRND	GROUND
GRTG	GRATING
GRVL	GRAVEL
GTV	GATE VALVE
GV	GAS VALVE
HB	HOSE BIBB
HDCP	HANDICAPPED
HDPE	HIGH DENSITY POLYETHYLENE
HDWL	HEADWALL
HORIZ.	HORIZONTAL
HP	HORSE POWER/HIGH PRESSURE
HT.	HEIGHT
HVAC	HEATING, VENTILATION AND AIR CONDITIONING
H.W.	HIGH WATER
H.W.L.	HIGH WATER LEVEL
HWSEL.	HIGH WATER SURFACE ELEVATION
HWY	HIGHWAY
HYD	HYDRAULIC
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
IN.	INCH
INF.	INFLUENT
INV.	INVERT
IPF	IRON PEN FOUND
JB	JUNCTION BOX
JCT	JUNCTION
JST	JOIST
JT	JOINT
LAT.	LATITUDE
LB.	POUND
LBL	LABEL
L.F.	LINEAR FEET
LIN	LINEAL, LINEAR
LONG.	LONGITUDE
LP	LOW POINT/LONG PATTERN
LT	LEFT
LVR	LOUVER
MAX.	MAXIMUM
MB	MAIL BOX
MCC	MOTOR CONTROL CENTER
MFG	MANUFACTURER/MANUFACTURING
MGD	MILLION GALLONS PER DAY
M.H.	MANHOLE
MI.	MILE/MILES
MIN.	MINIMUM
MISC.	MISCELLANEOUS
MJ	MECHANICAL JOINT
MT.	MOUNT
MTL	METAL
MTR	MOTOR
N	NORTH
NIC	NOT IN CONTRACT
NO.	NUMBER
NOM	NOMINAL
NORM	NORMAL
NTS	NOT TO SCALE
NWSEL.	NORMAL WATER SURFACE ELEVATION
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
OVFL	OVERFLOW
P	POWER
P.C.	POINT OF CURVE
PE	PLAIN END
PEJ	PIPE EXPANSION JOINT
PH.	PHASE
P.I.	POINT OF INTERSECTION
PKWY	PARKWAY
ℙ	PROPERTY LINE
PLBG	PLUMBING
P-O	PUSH ON
PP	POWER POLE
PRESS	PRESSURE
PRKG	PARKING
PROJ	PROJECT
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
P.T.	POINT OF TANGENT
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PNL	PANEL
PSF	POUNDS PER SQUARE FOOT
PVMT	PAVEMENT
QTR	QUARTER
QTY	QUANTITY
R.	RANGE
RAD	RADIUS
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RED.	REDUCER
REF	REFERENCE
REG	REGULAR
REINF	REINFORCING
REM	REMOVE
REQ'D	REQUIRED
RES.	RESIDENCE
RET	RETAINER/RETAINING
REV	REVISE/REVISION
RJ	RESTRAINED JOINT
ROW	RIGHT-OF-WAY
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RT	RIGHT
S	SOUTH
SAN.	SANITARY
SCH	SCHEDULE
SD	STORM DRAIN
SEC.	SECTION
SHLDR.	SHOULDER
SHT	SHEET
SIM	SIMILAR
SL	SURVEY LINE
SLV	SLEEVE
SPECS	SPECIFICATIONS
SQ.	SQUARE
SQ. FT.	SQUARE FEET
SQ. YD.	SQUARE YARD
SS	SANITARY SEWER
ST	STREET
STA.	STATION
STD.	STANDARD
ST. STL.	STAINLESS STEEL
STM.	STORM
STM. SEW.	STORM SEWER
STR	STRAIGHT
STRUC	STRUCTURAL
SW	SIDE WALK
SWD	SIDE WATER DEPTH
SYS	SYSTEM
T	TELEPHONE
T.	TOWNSHIP
T&B	TOP AND BOTTOM
TAN.	TANGENT
TAN. TO C.	TANGENT TO CURVE
TBM	TEMPORARY BENCHMARK
TEMP	TEMPORARY
THK.	THICK/THICKNESS
THRU	THROUGH
TOC	TOP OF CURB
TOW	TOP OF WALL
TYP.	TYPICAL
UNO	UNLESS NOTED OTHERWISE
UP	UNDERGROUND POWER
UT	UNDERGROUND TELEPHONE
UTIL	UTILITY
UV	ULTRAVIOLET
V	VALVE
V.C.P.	VITRIFIED CLAY PIPE
VERT.	VERTICAL
V.F.	VERTICAL FEET
V.G.	VALLEY GUTTER
V.P.C.	VERTICAL POINT OF CURVE
V.P.I.	VERTICAL POINT OF INTERSECTION
V.P.T.	VERTICAL POINT OF TANGENT
W	WATER
W	WEST
W/	WITH
W/O	WITHOUT
WM	WATER METER
WS	WATERSTOP
WSEL.	WATER SURFACE ELEVATION
WT.	WEIGHT
WTM	WATER TRANSMISSION MAIN
WV	WATER VALVE
W.W.	WING WALL
WWF	WELDED WIRE FABRIC
YD.	YARD
YR.	YEAR

D1 ABBREVIATIONS

SECTION NUMBER / SHEET NUMBER

SECTION MARKER

DETAIL NUMBER / SHEET NUMBER

DETAIL MARKER

BUILDING SECTION

WALL SECTION

SECTION/DETAIL APPEARS ON SAME SHEET

B-1 SOIL TEST BORING

DEMOLITION AND DISPOSAL

A1 GENERAL SYMBOLS

STORM DRAIN MANHOLE

SANITARY SEWER MANHOLE

SANITARY SEWER CLEANOUT

SANITARY SEWER (GRAVITY)

SANITARY SEWER (FORCEMAIN)

WATER LINE (SIZE NOTED)

NON-CONNECTING PIPING

WATER METER (SIZE NOTED IF LARGER THAN 3/4")

WATER VALVE

FIRE HYDRANT

AIR RELEASE VALVE

GAS LINE (SIZE NOTED)

GAS METER

GAS LAMP

GAS VALVE

GAS REGULATOR

UTILITY LINE MARKER

OVERHEAD POWER LINE

UNDERGROUND POWER LINE

POWER/TELEPHONE LINE

HIGH VOLTAGE TRANSMISSION TOWER/POLE

UTILITY POLE

LIGHT POLE

GUY WIRE

POWER MANHOLE

OVERHEAD TELEPHONE LINE

UNDERGROUND TELEPHONE LINE

FIBER OPTIC CABLE (UNDERGROUND)

CABLE TV (UNDERGROUND)

TELEPHONE MANHOLE

TELEPHONE PEDESTAL

JUNCTION BOX (LETTER DENOTES UTILITY) { P - POWER; T - TELEPHONE; C - CABLE TV; F - FIBER OPTIC

D7 EXISTING UTILITIES

SECTION LINE

1/4 SECTION LINE

1/4-1/4 SECTION LINE

SECTION CORNER OR 1/4 SECTION CORNER (TYPE AND DESCRIPTION NOTED)

CITY OR TOWN LIMITS

PROPERTY LINE

IPF IRON PIN FOUND (SIZE AND TYPE NOTED)

IPS IRON PIN SET (SIZE AND TYPE NOTED)

A4 SURVEYING SYMBOLS

SURVEY LINE AND POINT OF INTERSECTION

BENCHMARK

MONUMENT (SIZE AND TYPE NOTED)

ROW RIGHT-OF-WAY LINE

ESMT. PERMANENT EASEMENT BOUNDARY

LAND HOOK

MANHOLE

CLEANOUT

UTILITY LINE (SIZE AND TYPE NOTED)

ENCASED PIPE (I.D. OF CASING & CARRIER NOTED)

NON-CONNECTING PIPING

WATER METER (SIZE NOTED IF LARGER THAN 3/4")

VALVE (TYPE NOTED)

FIRE HYDRANT

AIR RELEASE VALVE

TAPPING SLEEVE AND VALVE

TAPPING SADDLE AND VALVE

SLEEVE

CONCRETE BRACE

PLUG W/CONCRETE CROSS ANCHOR

GAS METER

GAS LAMP

GAS REGULATOR

G10 PROPOSED UTILITIES

TREE

SHRUB

HEDGEROW

TREE LINE/WOODED AREA

ROCK OUTCROPPING

SLOPE

FLOWER BED, GARDEN, ROCK GARDEN (NOTED)

RIVER/STREAM (ARROW INDICATES FLOW)

INTERMITTENT DITCH OR STREAM

LAKE

LAKE OR POND

SWAMP OR MARSH

500 / 499 EXISTING GROUND CONTOUR

500 / 499 FINISH GROUND CONTOUR

RAILROAD

FENCE (TYPE NOTED)

MAILBOX

TRAFFIC/STREET SIGN

OUTDOOR ADVERTISING SIGN (BILLBOARD)

EXISTING BUILDING/STRUCTURE

EXISTING STORM DRAIN W/HEADWALL (SIZE AND TYPE NOTED)

NEW STORM DRAIN W/HEADWALL (SIZE AND TYPE NOTED)

EXISTING BRIDGE OR CULVERT

EXISTING ASPHALT ROAD OR DRIVE

NEW ASPHALT ROAD OR DRIVE

EXISTING ASPHALT ROAD WITH CURB AND GUTTER (DRAINAGE INLET SHOWN)

NEW ASPHALT ROAD WITH CURB AND GUTTER (DRAINAGE INLET SHOWN)

EXISTING CONCRETE ROAD OR DRIVE

NEW CONCRETE ROAD OR DRIVE

EXISTING UNPAVED ROAD OR DRIVE

NEW UNPAVED ROAD OR DRIVE

A10 TOPOGRAPHY & INFRASTRUCTURE SYMBOLS

KREBS ENGINEERING

ALABAMA LICENSED PROFESSIONAL ENGINEER No. 25751 3/15/23 KREBS ENGINEERING, LLC ALLEN

JOB No. 21014

CITY OF NORTHPORT UTILITIES
WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I
NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

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Revisions

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Sheet Title: STANDARD SYMBOLS & ABBREVIATIONS

Issue Date: MAR., 2023

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Sheet No.: G0-03

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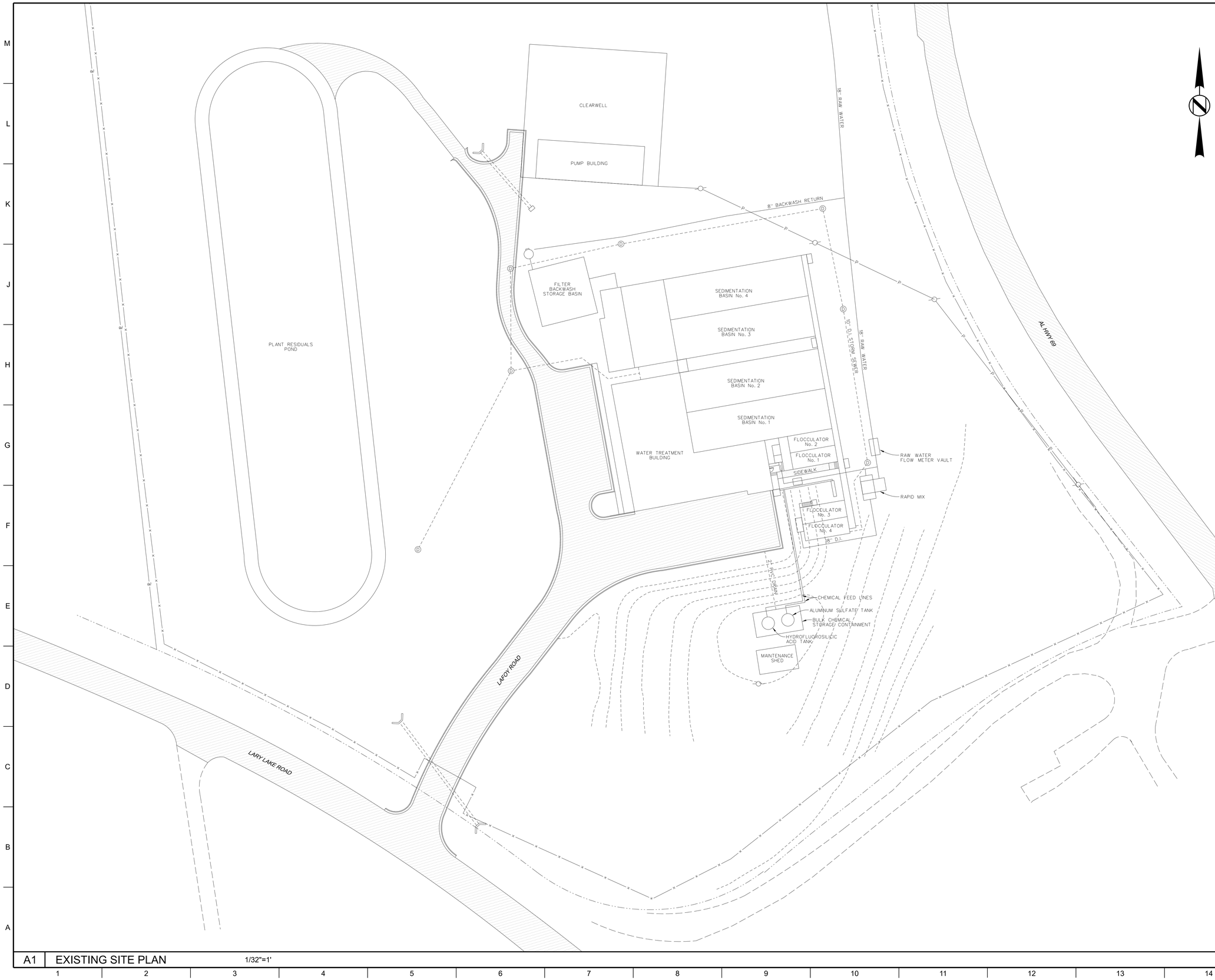

KREBS ENGINEERING

ALABAMA LICENSED No. 25751 PROFESSIONAL 3/15/23 ENGINEER JACK L. ALLEN

JOB No. 21014

CITY OF NORTHPORT UTILITIES

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Revisions

No.	Date	Description

Sheet Title: EXISTING SITE PLAN

Issue Date	Sheet No.
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A1 | EXISTING SITE PLAN | 1/32"=1'

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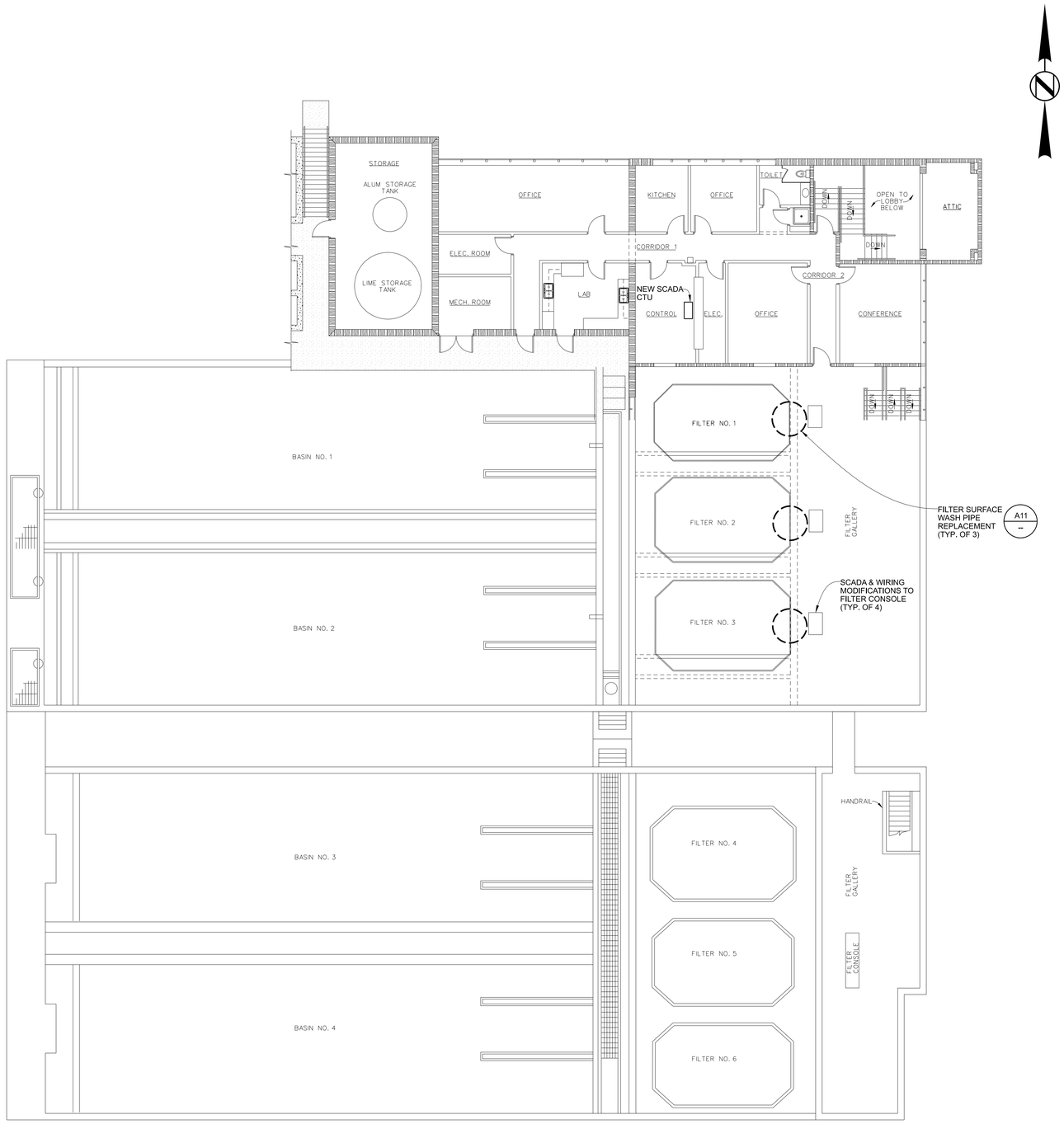
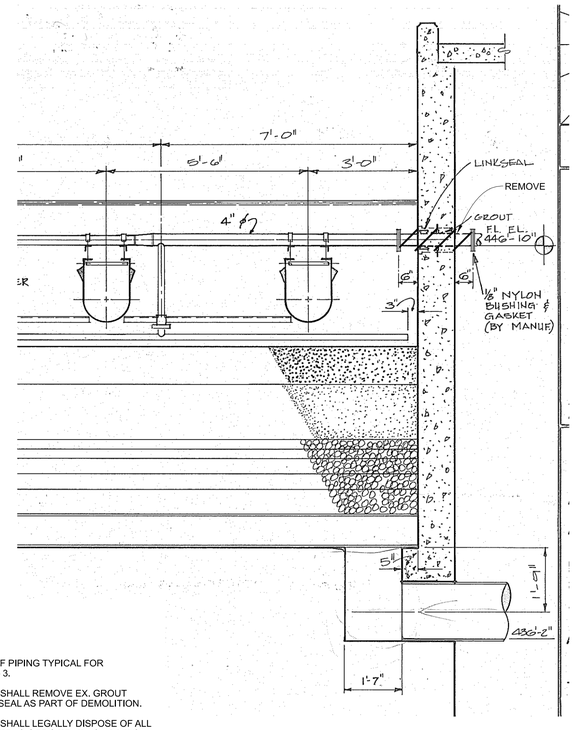


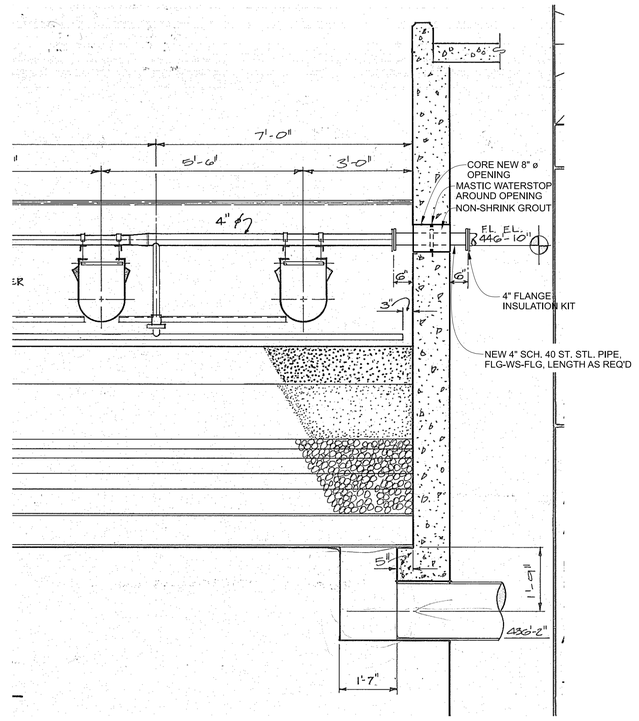
A1 | PLAN | 3/32"=1'-0"



NOTES:

1. DEMOLITION OF PIPING TYPICAL FOR FILTERS No. 1 - 3.
2. CONTRACTOR SHALL REMOVE EX. GROUT FILL AND LINK SEAL AS PART OF DEMOLITION.
3. CONTRACTOR SHALL LEGALLY DISPOSE OF ALL DEMOLISHED ITEMS OFF-SITE AT NO ADDITIONAL COST TO THE OWNER.

G11 | SURFACE WASH PIPE DEMOLITION SECTION | NO SCALE



NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS

A11 | SURFACE WASH PIPE DETAIL | NO SCALE

KREBS ENGINEERING

ALABAMA LICENSED No. 25751 PROFESSIONAL ENGINEER 3/15/23 JACK L. ALLEN

JOB No. 21014

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WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I

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No.	Date	Description

Sheet Title

OPERATING FLOOR IMPROVEMENT PLAN

Issue Date	Sheet No.
MAR., 2023	C1-01
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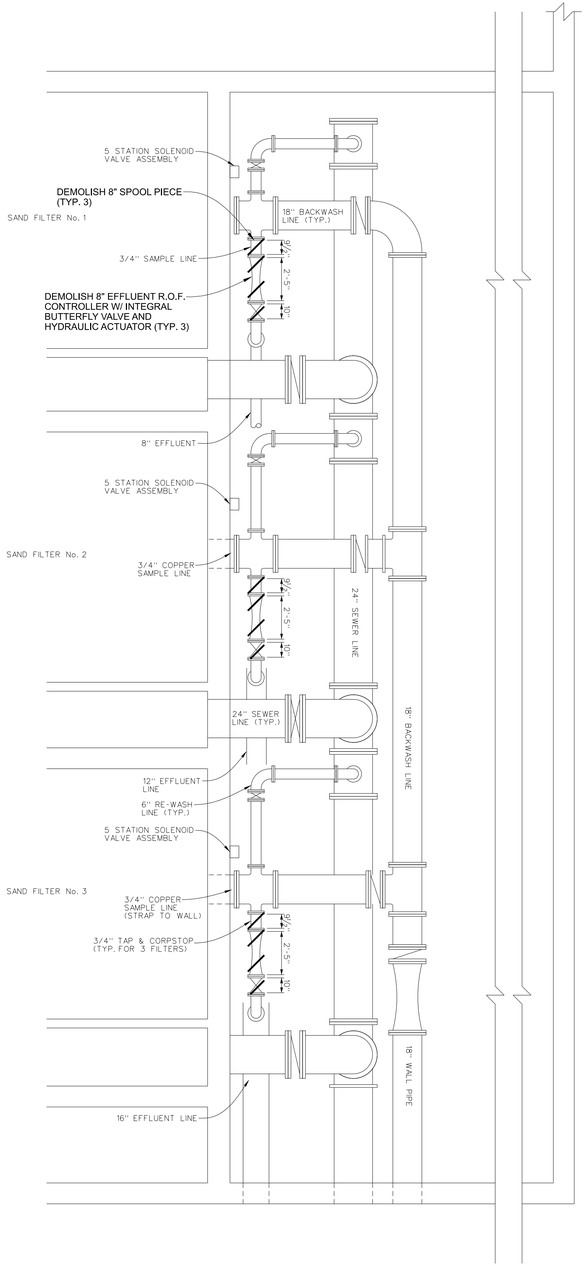
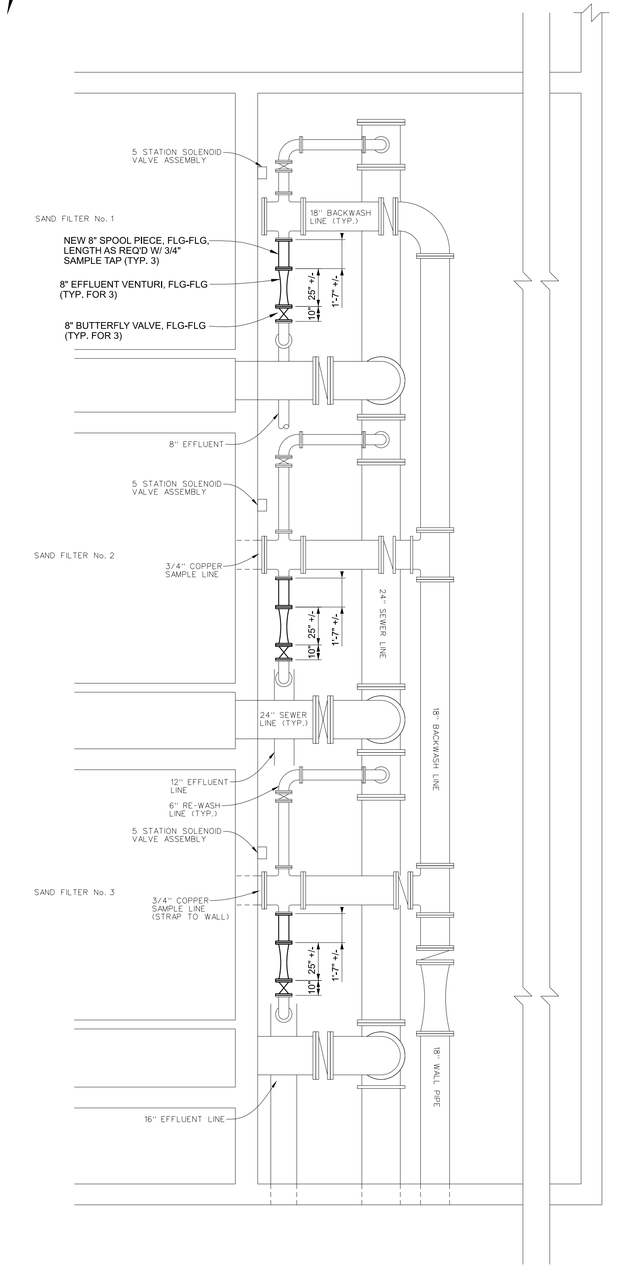


NOTES:

1. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL MATERIALS AND EQUIPMENT ASSOCIATED WITH EFFLUENT RATE OF FLOW CONTROLLERS AND ACTUATORS.
2. CONTRACTOR SHALL DISCONNECT HYDRAULIC CONTROL PIPING AND ABANDON CONNECTION TO VALVE MANIFOLD ASSEMBLY.

A1 EXISTING/DEMOLITION PLAN 1/4"=1'-0"

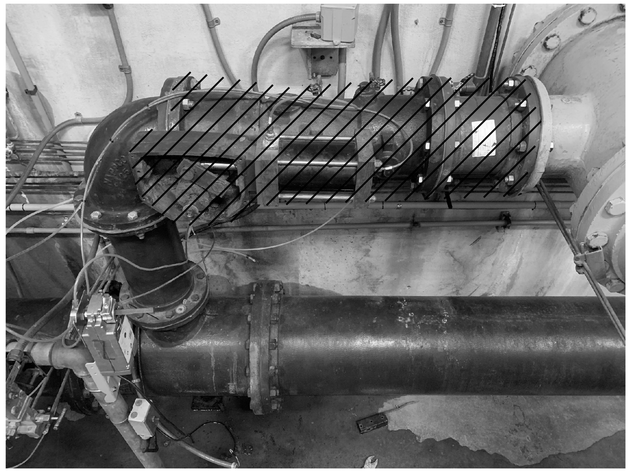


NOTES:

1. OWNER HAS PRE-PURCHASED 8" RATE OF FLOW CONTROLLER (8" VENTURI TUBE AND 8" ACTUATED BUTTERFLY VALVE). SEE APPENDIX B FOR SUBMITTALS
2. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFING REQUIRED PIPING MODIFICATIONS FOR INSTALLATION OF NEW EQUIPMENT.
3. CONTRACTOR SHALL COAT NEW PIPING AND VALVES IN ACCORDANCE WITH SPECIFICATIONS.

A6 IMPROVEMENTS PLAN 1/4"=1'-0"

A11 TYP. VENTURI PHOTOGRAPH NO SCALE



KREBS ENGINEERING

ALABAMA LICENSED No. 25751 PROFESSIONAL ENGINEER 3/15/23 JACK L. ALLEN

JOB No. 21014

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WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I
NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

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No.	Date	Description

Sheet Title
FILTERS 1-3 GALLERY DEMOLITION PLANS & SECTION

Issue Date MAR., 2023 | Sheet No. C1-02

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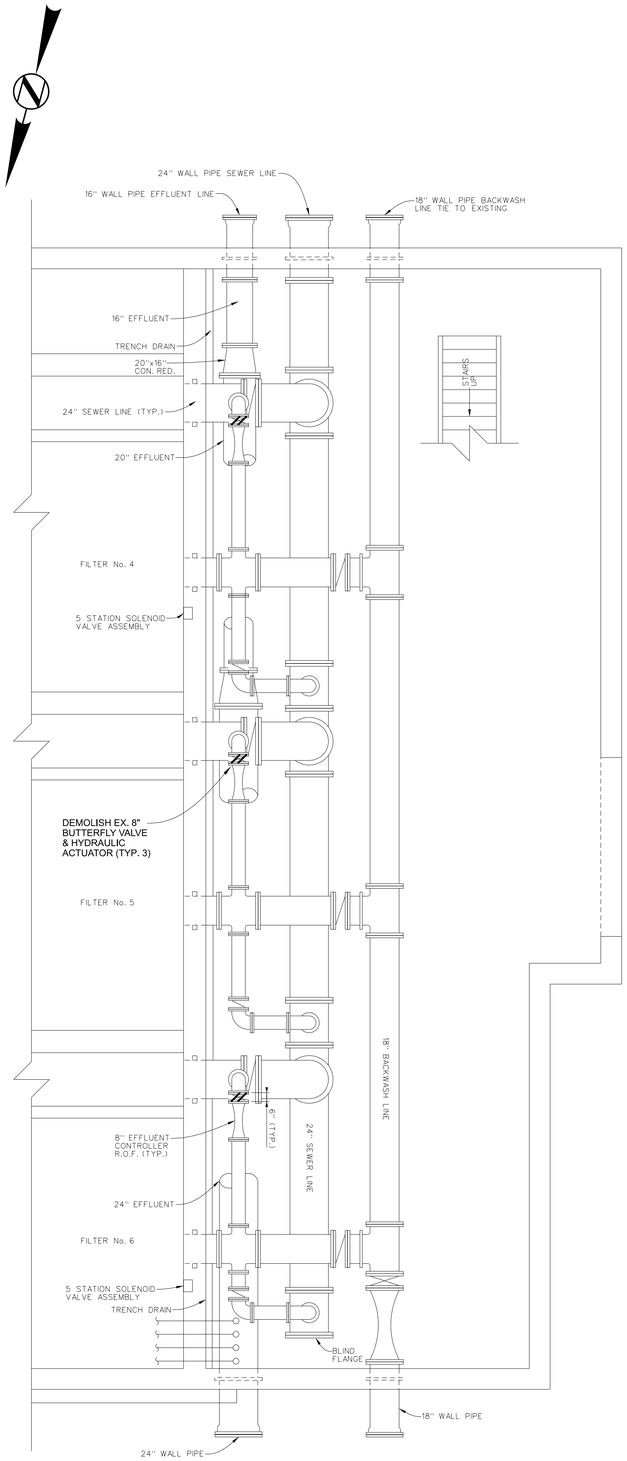
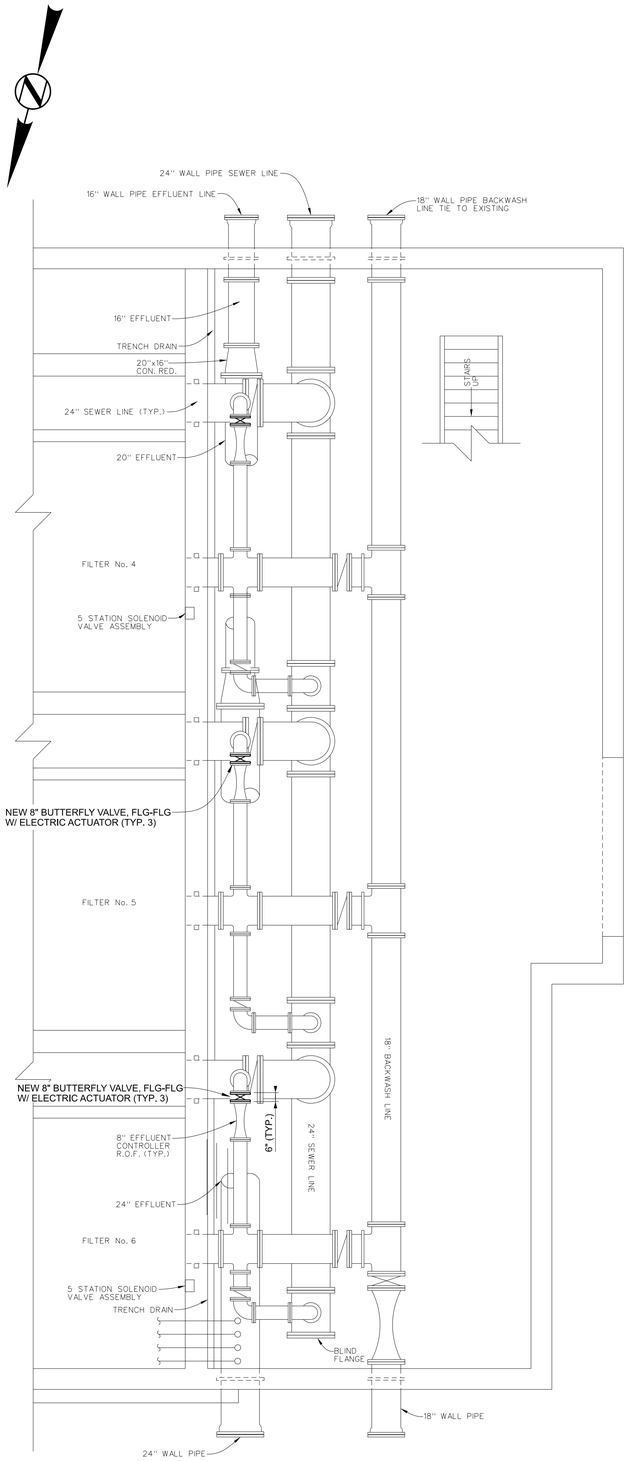


NOTES:

1. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL MATERIALS AND EQUIPMENT ASSOCIATED WITH EFFLUENT RATE OF FLOW CONTROL VALVES AND ACTUATORS.
2. CONTRACTOR SHALL DISCONNECT HYDRAULIC CONTROL PIPING AND ABANDON CONNECTION TO VALVE MANIFOLD ASSEMBLY

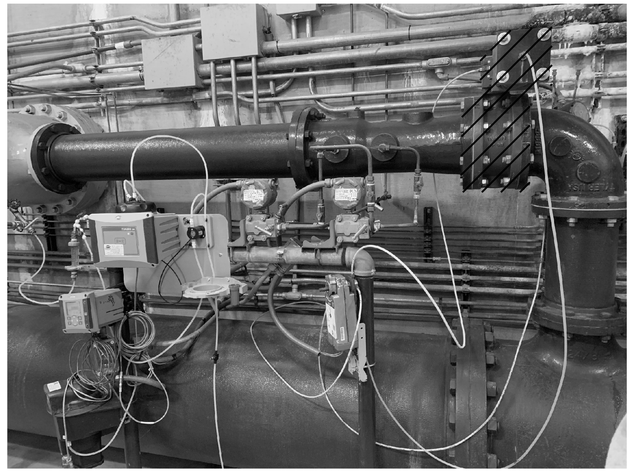
A1 EXISTING/DEMOLITION PLAN 1/4"=1'-0"

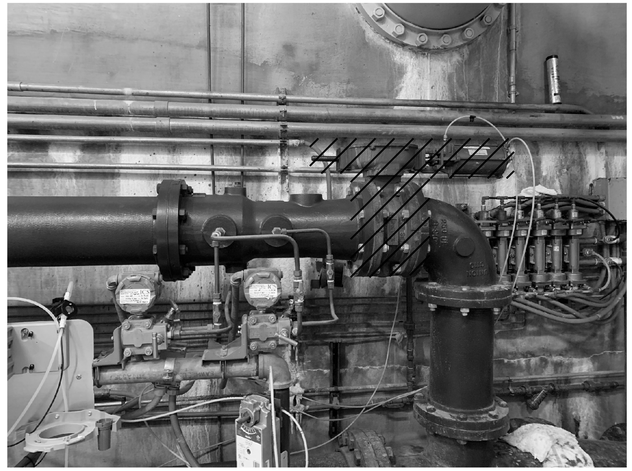


NOTES:

1. OWNER HAS PRE-PURCHASED 8" ACTUATED BUTTERFLY VALVE. SEE APPENDIX B FOR SUBMITTALS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFING REQUIRED PIPING MODIFICATIONS FOR INSTALLATION OF NEW EQUIPMENT.
3. CONTRACTOR SHALL COAT NEW PIPING AND VALVES IN ACCORDANCE WITH SPECIFICATIONS.

A6 IMPROVEMENTS PLAN 1/4"=1'-0"





A11 TYP. VENTURI PHOTOGRAPH 1/4"=1'-0"

KREBS ENGINEERING

ALABAMA LICENSED PROFESSIONAL ENGINEER No. 25751 3/15/23 CHRISTOPHER L. ALLEN

JOB No. 21014

CITY OF NORTHPORT UTILITIES
WATER TREATMENT PLANT FILTER AND SCADA IMPROVEMENTS PH. I
NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

Designed MKM	Project No. 21014
Drawn NTS/MKM/JAD	
Checked CLL/JAD	

Revisions

No.	Date	Description

Sheet Title: FILTERS 4-6 GALLERY DEMOLITION PLANS & SECTION

Issue Date: MAR., 2023

Sequence: 7 of 13

Sheet No.: C1-03

BMM-MNGL-09
3/15/2023
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GENERAL ELECTRICAL NOTES

1. SPECIAL ATTENTION IS CALLED TO THE FACT THAT THE REQUIRED WORK IS AT OPERATING FACILITIES, AND AS SUCH, NO UNNECESSARY SHUTDOWNS WILL BE ALLOWED. ANY NECESSARY SHUTDOWNS SHALL BE APPROVED IN WRITING BY THE PLANT MANAGER A MINIMUM OF TWO (2) WEEKS IN ADVANCE. TEMPORARY/PORTABLE PUMPING PROVISIONS (AND OTHER TEMPORARY PROVISIONS AS REQUIRED FOR OPERATION OF THE EXISTING SYSTEMS) SHALL BE PROVIDED BY THE CONTRACTOR IF OWNER-MANDATED MAXIMUM SHUTDOWN PERIODS ARE ANTICIPATED OR ARE POSSIBLE.
2. ELECTRICAL PLANS & DETAILS INDICATE TYPICAL WIRING REQUIREMENTS FOR PROCESS EQUIPMENT. VERIFY EXACT WIRING REQUIREMENTS & ALL DEVICE LOCATIONS WITH APPROVED MANUFACTURERS SHOP DRAWINGS PRIOR TO ROUGH-IN. NO ADDITIONAL COMPENSATION WILL BE PAID FOR MINOR CIRCUITRY ADJUSTMENTS REQUIRED TO COMPLY WITH MANUFACTURERS INSTALLATION DETAILS.
3. CONTRACTOR SHALL VISIT THE SITE(S) OF THE WORK PRIOR TO SUBMITTING BID TO EXAMINE CAREFULLY LOCAL CONDITIONS AND DIFFICULTIES TO BE ENCOUNTERED. ANY DISCREPANCY BETWEEN PLANS AND EXISTING CONDITIONS SHALL IMMEDIATELY BE CALLED TO THE ATTENTION OF THE ENGINEER.
4. ALL EQUIPMENT SHALL BE GROUNDED AND BONDED IN ACCORDANCE WITH NEC.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLATION AND MOUNTING OF ALL INSTRUMENTATION DEVICES. SEE INSTALLATION DETAILS ON CIVIL & ELECTRICAL DRAWINGS AND PROVIDED BY SUPPLIERS. COORDINATE ALL REQUIREMENTS WITH SUPPLIERS PRIOR TO ROUGH-IN.
6. REMOVE ALL EXISTING ELECTRICAL EQUIPMENT AND WIRING MADE OBSOLETE BY THIS RENOVATION AND DISPOSE OF AS DIRECTED BY THE ENGINEER.
7. THIS CONTRACTOR SHALL FURNISH ALL MATERIALS AND LABOR NECESSARY TO EXTEND CIRCUITS AND MAKE RECONNECTIONS TO ANY ACTIVE ELECTRICAL DEVICES ON WHICH THE BRANCH CIRCUIT IS INTERRUPTED BY THIS ALTERATION. CARE SHALL BE TAKEN TO INSURE THAT EXISTING PANEL AND FEEDER RATINGS ARE NOT EXCEEDED.
8. WET OR PROCESS AREAS (FOR USE IN DETERMINING TYPES OF MATERIALS REQUIRED PER ELECTRICAL SPECIFICATIONS) SHALL BE DEFINED AS ALL AREAS WITHIN THE PROJECT SCOPE EXCEPT THE FOLLOWING:
   A. OFFICES, RESTROOMS, BREAK ROOMS, ELECTRICAL ROOMS AND OTHER SIMILAR ANCILARY CONDITIONED SPACES.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING IDENTIFICATION/LABELING FOR ALL INSTRUMENTS, UTILIZATION EQUIPMENT (VALVE ACTUATORS, ETC.), CONTROL DEVICES, PANELBOARDS, ETC. (REGARDLESS OF WHICH ENTITY PROVIDES THE EQUIPMENT) PER DETAILED REQUIREMENTS OF SPECIFICATION SECTION 26 05 53.

GENERAL ELECTRICAL LEGEND

- BRANCH/FEEDER CIRCUIT – CONCEALED IN WALLS OR CEILING.
- BRANCH/FEEDER CIRCUIT – EXPOSED ON WALLS OR CEILING.
- BRANCH/FEEDER CIRCUIT – CONCEALED IN FLOOR SLAB OR DIRT FILL.
- BRANCH/FEEDER CIRCUIT – HOMERUN – CAN BE USED WITH OTHER BRANCH/FEEDER TYPES.

BRANCH/FEEDER CIRCUIT MODIFIERS:

- ——— : 2#12 & 1#12G UNLESS NOTED OTHERWISE.
- ———// : 3#12 & 1#12G, ETC. UNLESS NOTED OTHERWISE (TICK MARKS INDICATE CONDUCTOR QUANTITY NOT INCLUDING GROUND WIRE).
- ——10—— : 2#10 & 1#10G UNLESS NOTED OTHERWISE (NUMBER INDICATES WIRE AWG).

SIZE CONDUIT PER N.E.C. UNLESS INDICATED OTHERWISE.

- FLEXIBLE CONNECTION TO EQUIPMENT.
- POWER DISTRIBUTION EQUIPMENT.
- LIGHTING PANEL – SURFACE MOUNTED.
- CIRCUIT BREAKER.
- GROUND CONNECTION.
- MOTORIZED VALVE ACTUATOR OR GATE.
- FIT — FLOW INDICATING TRANSMITTER.
- *V*D — COMMUNICATIONS OUTLET – SEE DETAIL "E-CO" – *V*D REPRESENTS REQUIRED COMMUNICATIONS JACK CONFIGURATIONS.

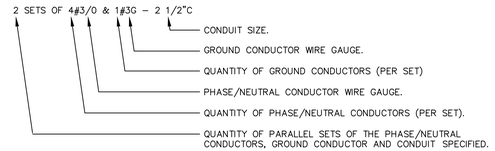
GENERAL ABBREVIATIONS:

(EX)	EXISTING TO REMAIN.
(EX-R)	EXISTING TO BE REMOVED – REMOVE ALL ASSOCIATED ELECTRICAL EQUIPMENT, DEVICES, CONDUIT AND WIRING CONNECTIONS TO OTHER ELECTRICAL ITEMS UNLESS SHOWN OTHERWISE.
(EX-RL)	EXISTING TO BE RELOCATED – REMOVE ALL ASSOCIATED ELECTRICAL EQUIPMENT, DEVICES, CONDUIT AND WIRING AT EXISTING LOCATION. RELOCATE ITEM TO NEW LOCATION SHOWN ON ELECTRICAL PLANS. EXTEND AND RECONNECT EXISTING CONDUIT, WIRING, ETC. TO NEW LOCATION AS REQUIRED UNLESS SHOWN OTHERWISE.
(EX-RP)	EXISTING TO BE REPLACED – EXTEND AND RECONNECT EXISTING CONDUIT AND WIRING TO REPLACED ITEM.

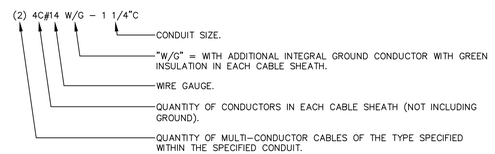
ELECTRICAL ABBREVIATIONS:

A	AMPERES.	NSV	NEW, SPARE OR VACATED.
AIC	AMPERES INTERRUPTING CAPACITY.	OC	ON CENTER.
AFF	ABOVE FINISHED FLOOR.	P	POLES.
AL	ALUMINUM.	PF	POWER FACTOR.
ATS	AUTOMATIC TRANSFER SWITCH.	ø	PHASE.
AWG	AMERICAN WIRE GAUGE.	PVC	POLYVINYL CHLORIDE.
C	CONDUIT.		
CU	COPPER.	SLD	SINGLE LINE DIAGRAM.
EC	EMPTY CONDUIT. OR ELECTRICAL CONTRACTOR	SS	STAINLESS STEEL.
		UL	UNDERWRITERS LABORATORY.
FPN	FUSE PER NAMEPLATE.	UNO	UNLESS NOTED OTHERWISE.
G	GROUND CONDUCTOR.	V	VOLTS.
KVA	KILOVOLT-AMPERES.	W	WIRES.
KW	KILOWATT.		
LV	LOW VOLTAGE.	CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED.
MCM	THOUSAND CIRCULAR MILS.		
MV	MEDIUM VOLTAGE.	CFOI	CONTRACTOR FURNISHED, OWNER INSTALLED.
N	NEUTRAL.		
NEC	NATIONAL ELECTRICAL CODE.	OFOI	OWNER FURNISHED, OWNER INSTALLED.
NEMA	NATIONAL ELECTRICAL MANUFACTURER ASSOCIATION.	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED.
NIC	NOT IN CONTRACT.		

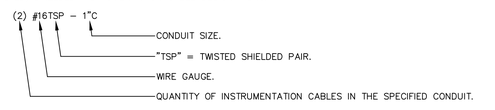
TYPICAL CIRCUITRY DESIGNATIONS:



MULTI-CONDUCTOR CONTROL 600V TRAY CABLE DESIGNATIONS:



TWISTED, SHIELDED INSTRUMENTATION CABLE DESIGNATIONS:



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3/17/2023

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WATER TREATMENT PLANT FILTER AND SCADA IMPROVMENTS PH. I
NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

Designed	PDB
Drawn	RGN
Checked	PDB
Project No.	21014

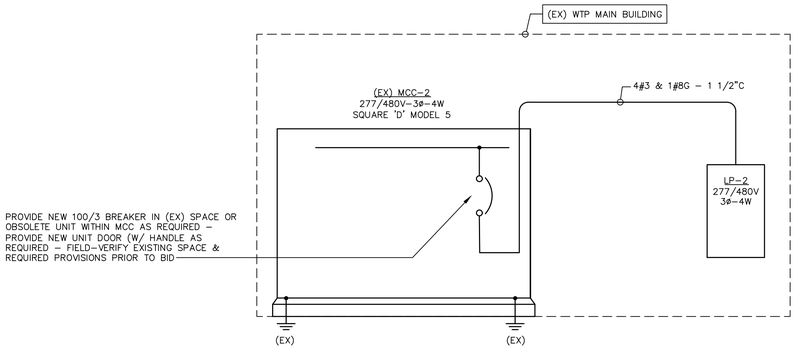
Revisions

No.	Date	Description

Sheet Title: ELECTRICAL LEGEND & NOTES

Issue Date	Sheet No.
MAR., 2023	E0-01
Sequence 8 of 13	

A1 | ELECTRICAL LEGEND & NOTES | SCALE: NONE



PARTIAL SINGLE LINE DIAGRAM

SCALE : NONE

DIAGRAM NOTES

1. THIS DIAGRAM IS INTENDED TO BE A PARTIAL DIAGRAM SHOWING NEW EQUIPMENT & FEEDERS ONLY. EXISTING UNAFFECTED EQUIPMENT & FEEDERS ARE NOT INTENDED TO BE SHOWN ON THIS DIAGRAM.
2. PROVIDE NEW ENGRAVED MASTER NAMEPLATES FOR NEW DISTRIBUTION EQUIPMENT (PANELS, ETC.) PER DETAIL "E-EDL".

PANELBOARD SCHEDULE - LP-2

PANEL TYPE:	SQUARE 'D' TYPE NF				AIC RATING:	30KAIC (MINIMUM)					
VOLTAGE	277/480V-3P-4W				MOUNTING:	SURFACE					
AMPS & TYPE:	100 AMP - MLO				LOCATION:	SEE PLANS					
FED FROM:	MCC-2				FEEDER:	SEE SINGLE LINE DIAGRAM					
CKT. NO.	NOTES	BKR	DESCRIPTION	WATTS	PHASE	WATTS	DESCRIPTION	BKR	NOTES	CKT NO.	
1	-	15/3	FILTER NO. 1 EFFLUENT VALVE	500	A		SPARE	15/3	-	22	
2	-	|	|	500	B		|	|	-	23	
3	-	|	|	500	C		|	|	-	24	
4	-	15/3	FILTER NO. 2 EFFLUENT VALVE	500	A		SPARE	15/3	-	25	
5	-	|	|	500	B		|	|	-	26	
6	-	|	|	500	C		|	|	-	27	
7	-	15/3	FILTER NO. 3 EFFLUENT VALVE	500	A		SPACE	20/1	-	28	
8	-	|	|	500	B		SPACE	20/1	-	29	
9	-	|	|	500	C		SPACE	20/1	-	30	
10	-	15/3	SPARE		A		SPACE	20/1	-	31	
11	-	|	|		B		SPACE	20/1	-	32	
12	-	|	|		C		SPACE	20/1	-	33	
13	-	15/3	SPARE		A		SPACE	20/1	-	34	
14	-	|	|		B		SPACE	20/1	-	35	
15	-	|	|		C		SPACE	20/1	-	36	
16	-	15/3	SPARE		A		SPACE	20/1	-	37	
17	-	|	|		B		SPACE	20/1	-	38	
18	-	|	|		C		SPACE	20/1	-	39	
19	-	15/3	SPARE		A		SPACE	20/1	-	40	
20	-	|	|		B		SPACE	20/1	-	41	
21	-	|	|		C		SPACE	20/1	-	42	

NOTES:
1. PROVIDE INTEGRAL 240KA (PER PHASE) SURGE PROTECTION DEVICE.

PH. A:	PH. B.	PH. C:
1,500	1,500	1,500

TOTAL CONNECTED LOAD:	4.5 KVA
	5.6 AMPS
TOTAL DEMAND LOAD:	4.5 KVA
	5.6 AMPS
TOTAL COMPUTED LOAD:	4.5 KVA
	5.6 AMPS

KREBS ENGINEERING

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WATER TREATMENT PLANT FILTER AND SCADA IMPROVMENTS PH. I
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Checked	PDB
Project No.	21014

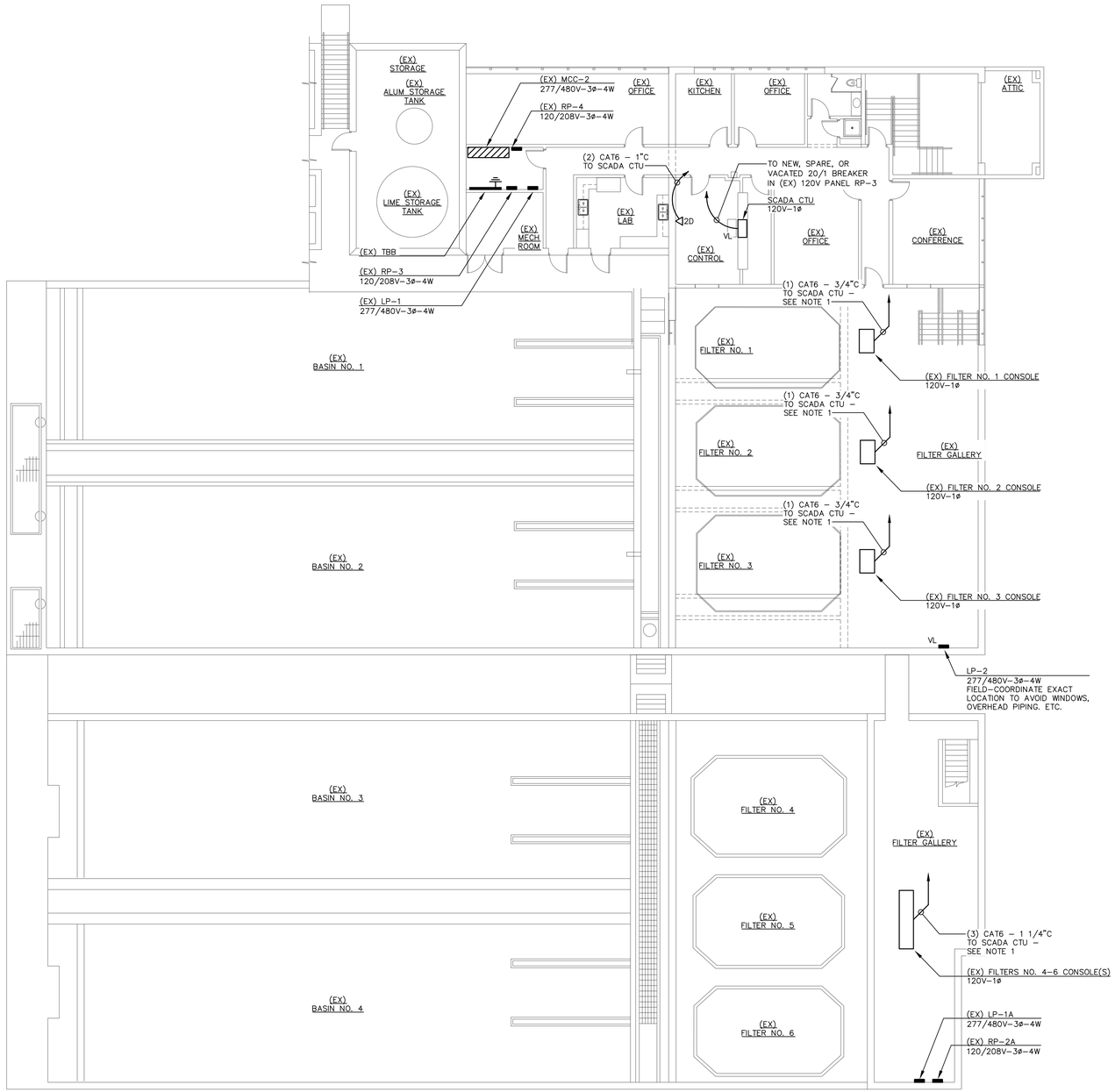
Revisions

No.	Date	Description

Sheet Title: DIAGRAM & SCHEDULE

Issue Date	MAR., 2023
Sequence	9 of 13
Sheet No.	E0-02

A1 | DIAGRAM & SCHEDULE | SCALE: NONE



PLAN NOTES

1. CONTRACTOR MAY, AT IT'S DISCRETION, REUSE EXISTING, UNUSED SPARE CONDUITS FROM EXISTING FILTER CONSOLES TO NEW SCADA CTU AREA (FOR NEW CAT6 CABLES) IF:

   A. SPARE CONDUITS EXIST AND ARE CURRENTLY EMPTY/UNUSED.
   B. SPARE CONDUITS ARE FOUND TO BE IN SERVICEABLE/USEABLE CONDITION.

A1 OPERATING FLOOR ELECTRICAL PLAN SCALE: 3/32" - 1'-0"

KREBS ENGINEERING

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No.	Date	Description

Sheet Title: OPERATING FLOOR ELECTRICAL PLAN

Issue Date	Sheet No.
MAR., 2023	E1-01
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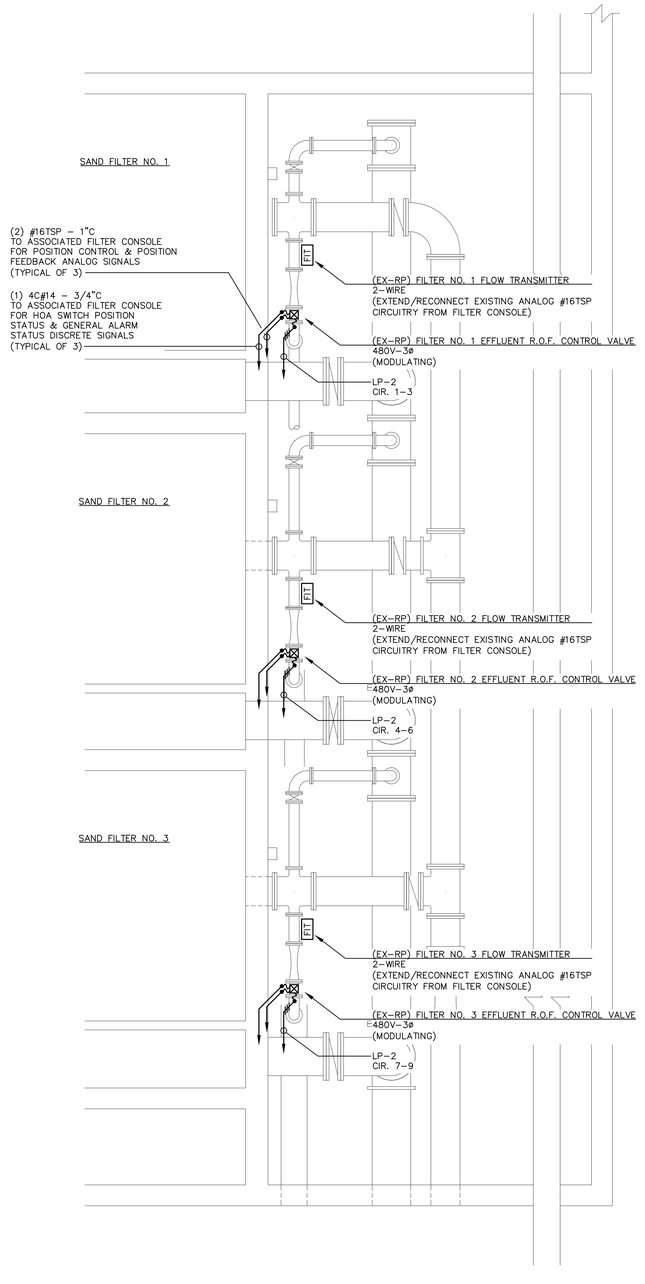

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PDB	21014
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Checked: PDB	

Revisions

No.	Date	Description

Sheet Title

FILTERS 1-3 GALLERY ELECTRICAL PLAN

Issue Date	Sheet No.
MAR., 2023	E1-02
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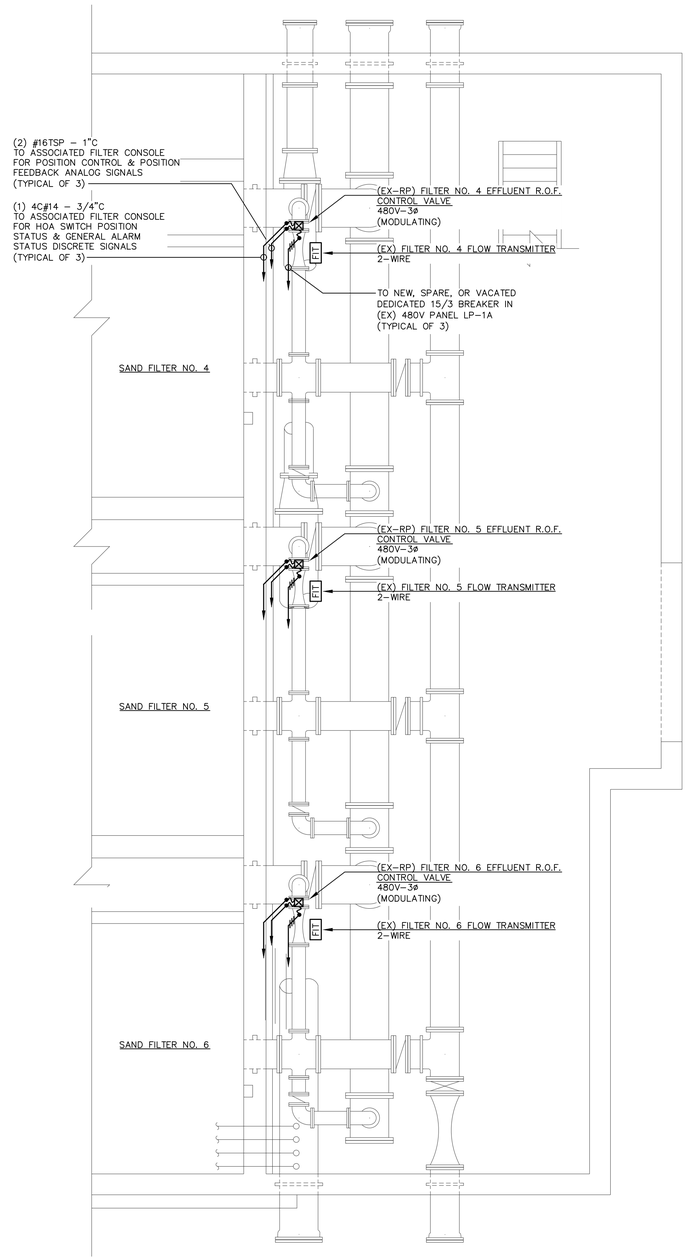
A1 FILTERS 1-3 GALLERY ELECTRICAL PLAN SCALE: 1/4" - 1'-0"



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Designed PDB	Project No. 21014
Drawn RGN	
Checked PDB	

Revisions

No.	Date	Description

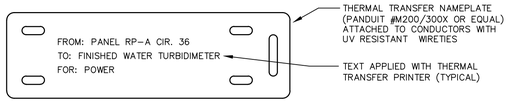
Sheet Title: FILTERS 4-6 GALLERY ELECTRICAL PLAN

Issue Date: MAR., 2023

Sheet No.: E1-03

Sequence: 12 of 13

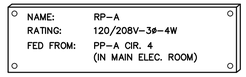
A1 FILTERS 4-6 GALLERY ELECTRICAL PLAN SCALE: 1/4" - 1'-0"



DETAIL "E-CL" TYPICAL CIRCUIT LABEL

SCALE : NONE

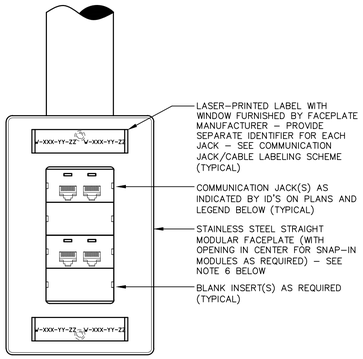
NOTES THIS DETAIL ONLY
1. CIRCUIT LABEL TYPES SHOWN ABOVE SHALL BE USED TO IDENTIFY ALL CIRCUITS WITHIN PULLBOXES, HANDHOLES, VAULTS JUNCTION BOXES LARGER THAN 4-11/16", APPROXIMATELY EVERY 50 FEET WITHIN CABLE TRAYS (INCLUDING AT MAJOR CABLE TRAY JUNCTIONS AND BREAKOUT LOCATIONS) AND AT OTHER SIMILAR LOCATIONS. SEE SPECIFICATIONS FOR LABELING REQUIREMENTS IN OTHER AREAS.
2. CIRCUIT NUMBERS SHALL BE IDENTIFIED FOR ALL CIRCUITS FED FROM LIGHTING OR POWER PANELBOARDS.
3. "FROM", "TO" & "FOR" TEXT SHOWN ABOVE ARE FOR EXAMPLE PURPOSES ONLY. NAMES/NUMBERS SHALL BE ADJUSTED TO MATCH ASSOCIATED CIRCUITS/CABLES.
4. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.



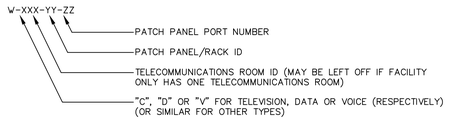
DETAIL "E-EDL" ELECTRICAL DISTRIBUTION EQUIPMENT LABEL

SCALE : NONE

DETAIL NOTES
1. PANEL NAMES & RATINGS LISTED ABOVE ARE FOR EXAMPLE PURPOSES ONLY. NAMES & RATINGS SHALL BE ADJUSTED TO MATCH ASSOCIATED EQUIPMENT.
2. THE INTENT OF THIS DETAIL IS TO DEMONSTRATE GENERAL ELECTRICAL IDENTIFICATION REQUIREMENTS FOR ELECTRICAL DISTRIBUTION AND UTILIZATION EQUIPMENT. REFER TO SPECIFICATIONS FOR SPECIFIC REQUIREMENTS REGARDING LOCATIONS, CONTENT, MATERIALS, ETC..



COMMUNICATION OUTLET ELEVATION



COMMUNICATION JACK/CABLE LABELING SCHEME

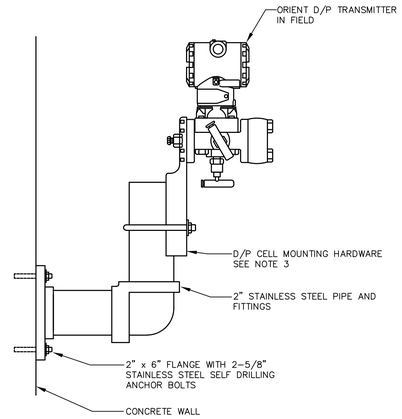
DETAIL "E-CO" COMMUNICATION OUTLET

SCALE : NONE

COMMUNICATION OUTLET LEGEND				
JACK ID(S) SHOWN ON PLANS	JACK TYPE(S)	ASSOCIATED HOMERUN CABLING FROM JACK (SEE NOTE 3 BELOW)	HOMERUN CABLING & CONDUIT TO (UNLESS SHOWN OTHERWISE ON PLANS)	REMARKS
*D	RJ45 DATA JACK(S)	CAT6 DATA CABLE(S).	SCADA CTU	

NOTES:

1. THE ASTERISK "*" WITHIN THE JACK ID SECTION ABOVE REPRESENT THE QUANTITIES OF EACH JACK/CABLE TYPE. FOR EXAMPLE, "3D" REPRESENTS THREE (3) DATA JACKS/CABLES.
2. THE JACK IDENTIFIERS SHOWN ABOVE MAY BE COMBINED TOGETHER ON PLANS. FOR EXAMPLE, THE IDENTIFIER "1V2D1C" REPRESENTS ONE (1) VOICE JACK/CABLE, TWO (2) DATA JACKS/CABLES AND ONE (1) COAXIAL TV JACK/CABLE. OUTLETS MAY CONSIST OF ANY COMBINATION OF THE ABOVE JACK TYPES.
3. ALL LOW VOLTAGE CABLING SHALL BE PLENUM-RATED.
4. PROVIDE A NYLON BUSHING ON EACH END OF EACH CONDUIT (SPECIFIED WITHIN NOTE 4 ABOVE) TO PROTECT CABLES.
5. COMMUNICATION OUTLET SHALL BE LOCATED A MAXIMUM OF 8 INCHES FROM THE ADJACENT POWER OUTLET.
6. COORDINATE LOCATION OF ALL OUTLETS WITH SCADA INTEGRATOR PRIOR TO ROUGH-IN.



DETAIL "E-DP" TYPICAL WALL MOUNTED D/P CELL INSTALLATION DETAIL

SCALE : NONE

DETAIL NOTES
1. INSTALLATION SHOWN IS TYPICAL. EXACT REQUIREMENTS SHALL BE DETERMINED BY APPROVED MANUFACTURER'S SHOP DRAWINGS.
2. REFER TO CIVIL DRAWINGS FOR ALL MECHANICAL PIPING REQUIREMENTS.
3. CONTRACTOR SHALL COORDINATE ALL EQUIPMENT MOUNTING HARDWARE REQUIREMENTS WITH INTRUMENTATION PROVIDER.
4. D/P CELL SHALL BE MOUNTED AT A HEIGHT SUCH THAT ALL PRESSURIZED LINES SLOPE DOWNWARD TOWARD INSTRUMENT WITH A MINIMUM CONTINUOUS SLOPE OF 1/4" PER FOOT (1" PER FOOT PREFERRED) UNLESS SPECIFICALLY REQUIRED OTHERWISE BY CIVIL ENGINEER.
5. SIMILAR PIPE-MOUNTING PROVISIONS SHALL BE PROVIDED FOR FLOOR-MOUNTED OR HANDRAIL-MOUNTED D/P TRANSMITTERS.

KREBS ENGINEERING

ALABAMA LICENSED No. 27420 PROFESSIONAL ENGINEER PHILIP D. BLACK

3/17/2023

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CITY OF NORTHPORT UTILITIES

WATER TREATMENT PLANT FILTER AND SCADA IMPROVMENTS PH. I

NORTHPORT, ALABAMA

CITY OF NORTHPORT UTILITIES 1871

Designed	Project No.
PDB	21014
Drawn: RGN	
Checked: PDB	

Revisions

No.	Date	Description

Sheet Title: ELECTRICAL DETAILS

Issue Date	Sheet No.
MAR., 2023	E2-01
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